The FOUNDRY

Volume 52
Number 23

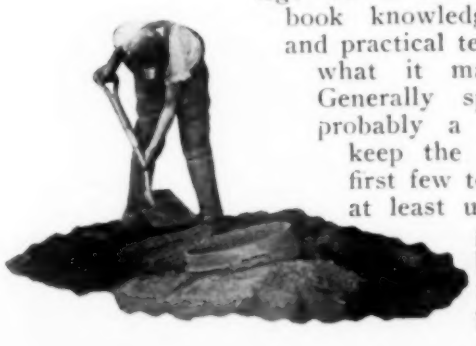
Published
Semimonthly

CLEVELAND, OHIO, DECEMBER 1, 1924

What An Apprentice Thinks

One Who Has Been Through the Mill Gives Pointers from His Experience and Portrays the Life on the Receiving End of an Apprenticeship Course

AN APPRENTICESHIP in a modern foundry is an interesting undertaking, especially so if the apprentice is not incapacitated by hard work. A green hand is obliged to pass through a sort of tumbling barrel filled with stars of foundry experience and to acquire a certain polish before he can begin to feel at home or is permitted to pick up the fine points of the business. In most cases he starts as a helper of some sort. The first striking discovery he makes concerns the actual value of rugged manual labor. A lame back and a pair of sore hands generally are indicative of this stage in his progress. As he becomes hardened and more accustomed to his particular tasks, he finds opportunity to observe what is going on about him. He discovers by actual contact the problems existing in the department where he is employed. The graduate of a technical school or college has a chance to give his book knowledge some real and practical tests, to find out what it may be worth. Generally speaking, it is probably a good idea to keep the results of the first few tests to himself, at least until he has a good idea that his answers are right. The employes in a foundry, the workmen, usually are a heterogeneous group of nationalities. Foreign born labor seems to have an undisputed hold on the available hard work in many foundries. About the first difficulty that confronts an apprentice student when he is assigned to help some old timer, who was born in Sweden or Poland and who never had time to learn much of the English language, is that of comprehending the commands and reprimands issued by his immediate superior. Some of these old timers delight in making their utterances so indefinite or inarticulate as to prohibit interpretation; while others will do all they can to show the beginner where the old ropes go and to explain why they go that way. If the apprentice happens to go to work for a man who is not keen on the idea of working himself, the apprentice sometimes gets a free rein to carry on the work under rather desultory supervision with the result that he learns how some things should not be done. He gets his first experience. Regardless of the first hundred mistakes, if the newcomer gets a general idea of the work being done and is not inclined to become excited when things seem messed up,



Measures Space to Definite Goal

BENT double over the sand heap, during the first few days, the new apprentice finds it difficult to imagine himself at the front office desk. He sees only immediate heavy toil and unsympathetic surroundings. How the beginner finds himself, his point of view of his work and the way in which he visualizes his goal is told attractively by the author of this article, who asks that his name be withheld. He was graduated from an eastern technical school and has served 18 months in a large gray iron and steel foundry making heavy work. THE EDITORS.

he soons find a place for himself and the men who may have seemed decidedly disinterested in his progress will become the finest of friends. In spite of the noise in a foundry, silence is golden. Often, too many questions of a more or less technical complexion will prove more harmful than instructive. A great deal of tact is necessary if one wishes to obtain reliable information first hand.

After a time the student becomes familiar with the major operations involved in the particular work he is doing. He is able to see ahead and plan the sequence of operations. Now he has an opportunity to try a little applied psychology and to show his

Sidelights Provide Interest in Daily Task

WHEN a good molder hands you his second-best slicker, after the pattern is drawn, and signifies by some strange gesture of the sign language that you are to go ahead and finish up one side of the job, then you're progressing. If he will shovel sand contentedly while you ram the job, you may decide that your application for membership has been accepted. When he gives you a portion of his mid-morning lunch, some Polish women are excellent cooks, or brings you a potato to bake in a core oven, you're in extra-special standing and may use any tool in his kit.

* * * *

THERE is an interesting bunch in most foundries. Men drift in from all parts of the earth. I've worked in a gang of four, with one from the shores of Lake Killarney, one from the Senegal in West Africa, one from a farm in Poland, while I am from Vermont. That assortment seems to indicate a labor supply that is drawn from many sources, geographically speaking. With Britishers, Swedes, Finns, Russians, Poles, Turks and the rest of the gang, one gets a chance to listen to travelogues and to stories of foreign conditions by men who have lived under them, obtaining information that tourists are bound to miss. Then there is a chance to study foreign languages. Most of the old country men are willing to teach you the simple phrases, which help when things go wrong and no one can understand English.

* * * *

AFTER the bunch finds out that you have been through college, and they have become acquainted, you are elected to a position of considerable prestige in the way of settling arguments, the answers to which may be found in books. One day I was asked to convince a Pole on the behalf of a fellow countryman, that although he was always hearing of Washington and Lincoln, they were not our first two presidents. Another day a French Canadian and an Irishman became warm about this word "receipt" and wanted to know how many ways there were of spelling it without changing the sound of it. I have figured quite a number of pay checks in cases where the paymaster had it right in the first place; determined how much tax the city should have if last year the valuation was so much; found the answers for dozens of these little trick problems where algebra showed the way; and decided what year Joe must have been born if he is quite sure that he is about 42.

Swedish or Polish superior that thinking is not necessarily a painful performance. By trying to keep about two steps ahead, mentally, and thus being able to pass up the tool, loose piece, or what-not needed, the apprentice will soon find his helper status disappearing and he will be *doubling up* like a regular. Of course, there is considerable danger of making mistakes, or becoming a nuisance and perhaps the one being assisted will refuse to recognize and to appreciate the efforts expended. A little patience and a ready play of good natured humor will help a great deal in backward cases.

As the student apprentice works his way through the various departments in the shop he has a wonderful opportunity to uncover and to study the working morale of those about him. He learns their way of looking at matters of management and the standards which they use in sizing up a man in an executive position. He discovers the tricks of the trade. Some of these discoveries probably are forced upon him. When he finishes his course he should be able to detect any number of methods employed in loafing on the job, with his own experiences in mind.

Always Be Yourself

There is no need to cultivate a role to get along with men. Quiet courtesy and a willingness to assume one's share, or a little more, of the hard or disagreeable duties will do all that. However, if at any time the beginner feels reasonably certain that he is being imposed upon, he should do all that discretion warrants in the way of *bawling out* the offender. A finished performance, embellished with the best foundry terms that may have been acquired, will create considerable prestige.

About this time, if everything has gone nicely, the student apprentice begins to hear real stories of the hard days before compressed air and electricity were put to work to help make castings. Stories of the days when good beer could be had over the fence and when the fancy sweep jobs were done. If the prospective foundryman keeps an interest up throughout the uninteresting portions of these recitals, and is careful to ask the right kind of questions, he is able to visualize the development of the shop and its practices through the preceding years. There are stories of mistakes and stories of clever stunts all tending to increase the listener's fund of general information. Some of the men may have learned their trade in foreign lands and others may have spent considerable time in other shops. Their stories have different settings and widely different themes.

The foundry in which a student apprentice serves his time and acquires his foundry experience and information is to some extent the basis of comparison he uses when inspecting other foundries. Each individual foundry possesses certain characteristics and the practices followed therein are affected accordingly. Thus an inspection trip through a number of foundries will disclose a number of variations, which automatically reveal themselves by the contrast they make with that with which the young foundryman is familiar. These incidents are a valuable part of an apprentice training, because they bring out points of good and bad foundry practice.

When a young man has been employed for some time in one department, alterations in methods, or rigging, suggest themselves if he takes time to think about them. However before making any ado over his schemes, it is a good idea to consult some of the older men about

the problems. There are chances that any obvious alteration would have been made previously if the resulting condition had possessed any advantage and it may be that the proposed alteration was carried out in the past and discarded for reasons not at first evident. Refinements in the matter of mechanical equipment have no place in a foundry if they cannot stand the gaff of rough service. It is relatively easy to design cumbersome or elaborate rigging, but it is equally difficult to plan a simple, easily operated, foundry-proof device. The young engineer should be cautious of perpetrating *fat-head ideas* which may be safe and sound only on paper.

Practical experience seems to be one of the most valuable prerequisites for the would-be foundryman. One of the advantages of a technical education lies in the fact that a man possessing such is better equipped to assimilate the actual existing practice and to determine those portions which are of real value. A student apprentice endeavors in the course of a comparatively short time to obtain as complete a resume of actual conditions as is possible. He literally tries to obtain years of experience in a few months time. His time has been wasted if he fails to gain considerable from the records of the past.

Weigh the Past

A certain amount of these data acquired is apt to be residual of old time practices which may have been discarded. Inventions and discoveries having opened new paths of development and in some cases rendered old day teachings obsolete. An apprentice cannot afford to miss a single opportunity of listening to any denunciation of modern methods by an old timer. The corrections or remedies necessary to make these modern methods more completely successful may be contained in the old timer's complaint. If something actually has been done, or if something else has been shown to be worthless, definite information has been established. In any case, the student apprentice should never permit himself to believe that developments seemingly impossible today will not be achieved in the future. One of the best and most vital contributions that young engineers can bring to the foundry as a whole is that of vision.

Inside of a year the novice should be able to decide whether or not, in his own opinion, he is adapted for a foundry career. If he decides to stay in the business, there are at least two distinct lines of procedure. *First.* He can work with the idea of becoming a foundry executive, a manager or superintendent of a foundry. *Second.* He can prepare to establish himself as a foundry engineer connected with some large manufacturing organization or acting in such a capacity as a consulting engineer.

It probably is impossible in most cases to prepare directly for any one particular position, the opportunities for advancement being dependent upon a great number of factors, but in any case it is possible for the young foundryman to determine in his own mind just what part he would like to play if he were given the power to create it. The establishment of a goal, or a policy of working ahead gives a direction to the preparation which a student makes in his training. When his apprenticeship is over, he ought to have the next logical step planned in his own mind. If he does not know what he wants to do, there is little chance that any one else does.

Train for the Job

The preparation for an executive position may be said to consist to some extent in specialization along the lines of management and production. The cost factors of producing a casting, the efficient use of labor, the prevention waste and reclamation projects and such kindred problems may be discerned by the beginner early in his training, and he can begin immediately to formulate his own ideas of their ultimate solutions. His close contact with the actualities, and his direct methods of reasoning often result in an accurate valuation of conditions.

The function of a foundry engineer is to further the development of the foundry industry in all its phases. Engineering specialization in this line is comparatively recent and offers splendid opportunities for graduates of engineering schools. The adaptation of scientific achievement for practical application, the design of new machines and labor saving rigging and the layout and construction of foundry buildings may be considered important phases of foundry engineering. Considerable research work is being carried on at present, but the great mass of work to be done has merely been started. The use of the X-ray to examine the interior of castings is an indication of what may be done in the future. The field for technical ability seemingly is limitless in the foundry business and, if given the incentive and encouragement it deserves, the industry as a whole is bound to prosper. As research laboratories are established, foundry-trained engineers will be necessary to take charge of the work and carry on investigation.

At first sight there does not seem to be any particular policy that a student apprentice need adopt if he decides to take up this branch of the engineering profession. In view of the extensive field covered by foundry engineering, the embryo foundry engineer will do well if he tries to acquire a general acquaintance with everything that comes his way pertaining to the casting of metal. Obtaining and recording information should be of primary importance. His future work will be fundamentally technical, management problems being generally of secondary importance except as the matters of cost establish certain terminations.

Offers Real Chance

The undergraduates of colleges and technical schools will be the engineers of the future. A great number of these young men do not appreciate the opportunities for profitable and interesting work in the foundry industry, simply because they are not cognizant of the real conditions. They have only a general impression of a foundry. They know nothing of the real problems existing under the sometimes annoying layers of smoke and dirt. If some project were inaugurated through the offices of foundry leaders by which these young men were informed concerning the foundry by those competent to talk about it, a beneficial work would be accomplished.

Some foundries are hot and dirty, and perhaps foundries as a whole have a little more than their share of rough, plain spoken men; but nothing of this nature will keep good men away from real opportunity. The crudeness of the old days, when most of the hard-shelled stories originated, is disappearing rapidly. Improvements in equipment, ventilation, lighting and sanitation steadily are coming to the fore. The so-called man-killing jobs that an apprentice comes in contact with are few and far between. There are some places around the furnaces and on the pouring floor where he finds plenty of heat and the other departments have their particular brands of hard work, but there is nothing that a normal healthy young man need worry about, especially if he is careful to make friends with the workmen about the place.

While the student apprentice is serving his training period, it is a good idea for him to keep a written record of all the various bits of information and data picked up. It will prove surprising how information on the same subject will vary, depending upon the source. The facts which were re-

(*Concluded on Page* 928)

Improve Shop Transportation

Substitution of Concrete Runways, Simplification of Department Arrangement and Adaption of Regularly Scheduled Tractor Trains Aids Foundry Handling

BY HERBERT R. SIMONDS

TRANSPORTING material is a business in itself, yet frequently hit-or-miss handling methods prevail in shops which otherwise are modern and efficient. Some manufacturers find it advisable to take from outside the organization an executive who has had experience in handling material, and who can study transportation problems from an independent or unbiased viewpoint. Such an expert often is able to introduce methods which one closer to the foundry might overlook.

The Walworth Mfg. Co., Boston, recently has investigated its material handling problems, and under the direction of an experienced man has organized a separate transportation department. This department has been successful. Not only have savings been made in direct costs, but the departmentalized accounts have uncovered inefficiency in other departments and in this way have been responsible for much saving of an indirect nature.

The development of the department has been so closely associated with the problems of the foundry that a brief description of the plant and its operation seems desirable before problems of transporting foundry materials are approached.

The chief products of the Walworth Mfg. Co. are pipe fittings and Stillson wrenches. The company operates two plants, one at Kewanee, Ill., and the other, with which this article is concerned, on a piece of land in South Boston bordering Boston Harbor. Raw material is received over a standard gage spur track which enters the property. The bulk of the fittings are of malleable iron which is produced in two cupolas located at the center of a long main foundry building. From the pouring floor the castings are conveyed successively to the hard cleaning department, the annealing ovens, the soft mills, the straightening and testing room, and then to the galvanizing department. After galvanizing, the stock is divided and goes to one of various finishing departments depending upon the individual character of the fittings. After tapping and machining, the fittings receive a final testing and then are taken to the shipping department. Most of the fittings are small, but some few run as high as 350 pounds each. The plant is somewhat scattered, and in one or two cases departments are on different levels.

Interest in the possibilities of improved methods of handling material first was aroused by a suggestion that valuable ground might be reclaimed by carrying waste material from the foundry to the edge of the high ground and dumping it onto tide flats which are part of the company property. It took but a small amount of figuring to demonstrate that the value of land thus reclaimed would more than offset the cost of the handling equipment required. Discussion of this phase of the question gradually led to more careful scrutiny of transportation methods. Finally it was decided, before purchasing equipment for land reclaiming, to organize an independent department devoted to transportation. Accordingly the present department was established, and R. E. Henchey was placed in charge. The first step in developing the department was a careful study of the existing transportation system. A large scale plan of the plant was made and on it were traced the movements of the different materials from receipt in the bins through to the finished parts sections and the waste dump. From this it was at once apparent that there was considerable doubling back in the movements of castings and other material.

FIG. 1—TRAIN LOADS OF WASTE MATERIAL GRADUALLY RECLAIM VALUABLE LAND FROM THE TIDE FLATS

For example, the galvanizing department which was in a separate building was reached from the soft cleaning department only by a circuitous path through the main foundry.

Form New Department

The mass of detail to be considered in forming an independent transportation department is large. New places where material is handled in one way or another continuously are coming to light, and these gradually must be taken over by the department. At the Walworth plant it is the intention to have all handling from the time the raw material enters the yard until it leaves as finished products placed under the jurisdiction of the transportation department. As it now stands, the department is in effect a separate organization which handles and transports material on schedule at definitely established rates. A scheme of charging the various other departments for the work of transportation has not been completely developed, but eventually the charges will be distributed on a ton-mile basis, and will show a profit above the cost of operating the various tractors, carts and elevators used.

As details in connection with the study of material handling problems and of the organization of a separate department are exhaustive, only a few of the important considerations can be given here. Conferences of different department heads were called to consider the question of relocating some of the departments to cut down length of haul. As a result it was found feasible to move the entire shipping department. Other improvements were made by cutting new openings in buildings and constructing inclined approaches to the upper levels. At last it was possible to work out a group chart and a definite

FIG. 2—A DOUBLE SYSTEM OF OVERHEAD TROLLEYS AFFORDS A FLEXIBLE MEANS FOR TRANSPORTING HOT METAL TO THE MOLDING FLOORS

time schedule for delivery of material. For the major work of transportation, tractor and trailer equipment was decided upon. Trailer stations or centralized points were created and equipped to fit the various needs.

Just what these trailer stations are, and what they accomplish may be better understood by tracing the flow of material through the plant in some detail.

Incoming freight cars left on the company siding by the railroad are shunted to desired points for unloading by a company locomotive. The material then is unloaded into bins or storage yards by a locomotive crane. In the case of pig iron, the cars are spotted opposite the cupolas and unloading into bins is by electro magnet. Coke also is stored in bins close to the cupolas. The charging floor of the cupolas is served by an elevator. Charging buckets mounted on wheels and hand operated are loaded at the bins, pushed some 15 or 20 feet onto the floor of the elevator, carried up to the charging floor, and then hand dumped into the cupolas.

Mixing is done on the charging floor which is large enough to provide for the storage of charging buckets. The desired number of buckets of the different materials are dumped to give the correct charge. The cupolas are tapped directly into ladles suspended from an overhead trolley which reaches every part of the foundry floor. Pouring into 100-pound trolley ladles is practically continuous. These ladles are equipped with handles similar to bicycle handles so that they easily may be pushed and poured by one man. This general scheme of pouring is shown in Fig. 2. From the trolley ladles individual hand ladles are filled at the various molders' floors, although for large work, it is the practice to pour directly from the trolley ladle.

Retain One Feature

This method of transporting the hot metal has not been changed in the general revision of the transportation system although it is at present the subject of careful scrutiny. It is a flexible system easily adapted to a marked increase or decrease in daily production. Two parallel trolleys, used on most runs, make it possible for the remote points of the foundry to be reached directly and quickly by one trolley while pouring is taking place at a near point from a ladle on the other trolley. This factor of quickness in delivery of material from

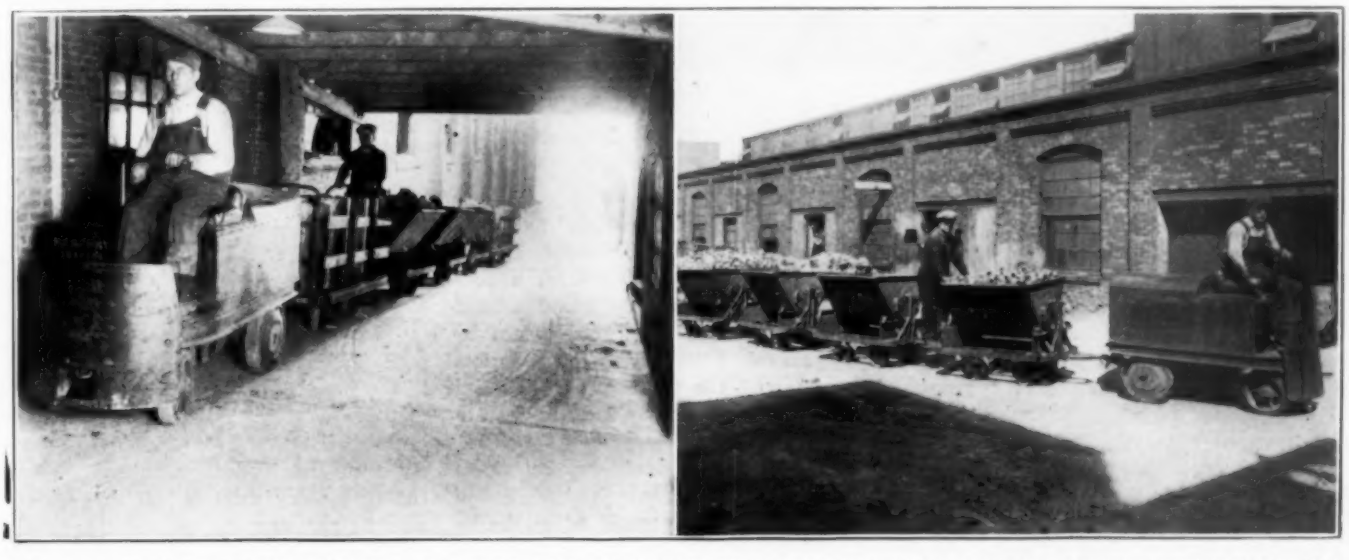


FIG. 3—A TEN PER CENT INCLINE IS NECESSARY TO REACH THE SECOND FLOOR OF ONE OF THE BUILDINGS FIG. 4—CONCRETE RUNWAYS CONNECT THE BUILDINGS MAKING TRACTOR DELIVERY PRACTICAL THROUGHOUT THE PLANT

cupola to mold takes precedence over any other factor in the foundry floor handling system.

New sand is carried from the bins to the molding floors in dump trailers and waste sand in a similar way is carried out to the water front as shown in Fig. 1. All the ground shown at the right in this illustration has been reclaimed by this method of reclaiming sand. Fig. 5 which is in direct contrast to Fig. 1 shows the old method of disposing of material.

From the pouring floor, fittings are hand forked into trolley buckets and pushed over the trolley system just described to the hard cleaning department located at one end of the main foundry. The tumbling barrels and other cleaning devices in this department dump the fittings directly onto a concrete floor. From here they are shoveled into barrows and wheeled to the loading floor of the annealing ovens where they are packed in four pot tiers, each tier being built up on a circular stool which holds the pot off the ground and thus permits raising by lift truck. A standard form of lift truck which was part of the equipment at the plant easily was adapted to take care of this work of charging the ovens. Two channels, forged to an offset shape, are fastened along the bed of the truck so as to drop down and form lifting arms which with the truck platform at its low position slip in under the tier of annealing pots, and thus raise the whole tier as the truck platform is raised. To keep the tier from tipping, two flat bars bent at right angles are fastened to the truck so that they extend upward, bracket fashion. To the upper end of these is bolted a semicircular cradle of the proper size snugly to fit around the upper pot. A short length of rope serves to hold this upper pot against the cradle and in this way the whole tier is held firmly in position.

This improvized scheme cost less than $100 and has proved satisfactory. From the annealing ovens, the fittings are shaken out and forked into containers, and then are taken by tractor train to the soft mills where they are tumbled or sand blasted as occasion may demand. The soft mills are arranged to dump directly upon a large circular sorting table, which is power driven, at a constant slow speed. Sorters stand around this table and pick out the fittings as they pass by. The number of sorters coincides with the number of styles and sizes of fittings, so that each selects but one size and style.

Cylindrical, galvanized-iron containers receive the sorted fittings, and when full are taken by hand truck to a nearby trailer loading station and later by tractor train to the straightening press room, and then again by tractor to the galvanizing foundry department for treatment.

Station No. 17 is shown under rush conditions in Fig. 8. Here pipe fittings are collected ready for transportation to the galvanizing department. After sorting, each fitting is trued on a straightening press and then is thrown into a cylindrical container, which when full is taken by hand truck, similar to the familiar station trunk truck, to a raised platform at the station. Here they are loaded upon trailers. The platform which is in the background cannot be seen in the illustration, but the higher elevation of some of the containers shows its location. Under normal practice, three or four trailers are left along the edge of this platform and the containers are loaded in place just as they are brought up on the platform from the press room. While these trailers are being loaded, the tractor is busy in other parts of the plant. The trailers must be loaded and ready on schedule time. A large time-table or schedule card is posted at each station and the arrival and departure of tractors and trains is kept within close time limits.

The large number of containers shown in Fig. 8 is an excess or reserve stock built up through some rush of work in the press room. As the production in the press room slackens, these extra containers will be wheeled up on the platform and loaded, and then if at the end of the day there is still an excess, it may be necessary to run an extra train. However, the schedule is figured so that under normal conditions the number of trips each day takes care of the day's production. The reserve stocks at each

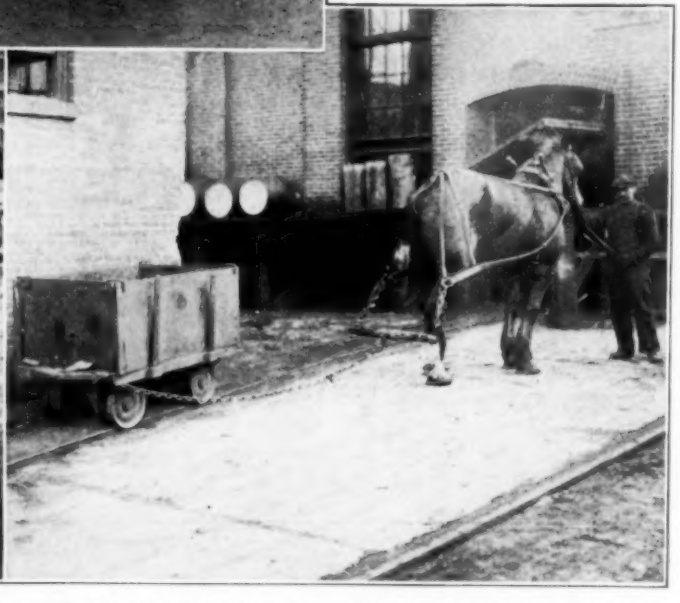


FIG. 5—TOP—DOBBIN OFTEN WAITED A FULL HOUR UNTIL A LOAD WAS READY FIG. 6—LEFT—NARROW GAGE TRACKS FORMERLY WERE USED TO HANDLE SCRAP FIG. 7—RIGHT—OCCASIONALLY HORSES WERE USED TO PULL THE HEAVIER CARS OVER THE NARROW GAGE TRACKS, BUT CONSIDERABLE TIME WAS LOST

station build up or decrease from time to time due to production irregularities in the foundry operation, but it is the intention to have the movement of material from the major stations practically constant throughout the day.

Concrete runways have been built connecting the various buildings, and in fact, wherever it is necessary to transport material by tractor trains. These runways are shown in Fig. 3 and Fig. 4 which are in sharp contrast to the former methods shown in Fig. 6 and Fig. 7. The concrete roadways in contrast to the narrow gage industrial track shown in Fig. 4 require a minimum of maintenance and the friction over them under actual yard conditions is so low that long trains may be handled easily with a small tractor. It is possible over a concrete runway to leave or pick up trailers as desired, or if occasion demands, the tractor may be unhitched, turned round, and the whole train easily reversed.

FIG. 8—LOADING STATIONS WERE ESTABLISHED AT CENTRAL POINTS—THESE ARE SERVED BY TRACTOR TRAINS ON REGULAR SCHEDULE

The trailer trains are used to take fittings from the galvanizing department to the various machine shops where they are tapped or threaded, machined, and tested. Here actual handling between different operations, because of the closeness of tools and the diversity of work is by hand in small containers. This is one of the few places where the handling operations have not yet come under the transportation department's jurisdiction. Because of cross travel among machines, it has been difficult to devise any good mechanical handling system such as a traveling belt or roller conveyor. However, the problems in this particular room are being studied and eventually some scheme of simplified handling is expected to bring even this case within the scope of the transportation department.

From the testing department the fittings are taken to stock bins by hand truck for small work and by flat trailers for pieces weighing from 100 to 350 pounds. A small hoist is used to load the large pieces onto the trailers.

In general this is the work and plan of the transportation department. Many of the difficulties encountered have been passed over, or only lightly mentioned. The paper work in separating charges for a department of this sort from the general plant charges is somewhat complicated. Maintenance of equipment, cost of charging storage batteries, work of cleaning loading stations, care of yard crane, maintenance of standard gage track are but a few of the items which help to run up the expense of the transportation department, and all these of course must be considered in determining a ton-mile charge rate for handling material.

Note Faulty Pistons

By George A. Drysdale

Question: We are forwarding to you two pistons and one piston core. We are getting a large number of these pistons with pin holes in the head and do not seem to be able to get away from this trouble. We are losing approximately 20 per cent of our castings on this account. We would be pleased to receive any information that you can give us to remedy this trouble. Following is an analysis of the iron that we are using. Silicon 2.80, sulphur 0.081, phosphorus 0.187, manganese 0.54, carbon 3.32 per cent.

Answer: The iron you are using, judging by the chemical analysis as given is suitable for your purpose. We assume that you use about 10 per cent of steel scrap in your cupola mixture to toughen your castings and the high silicon to eliminate any shrinkage that would have a tendency to show up around the boss.

It is our opinion that the gas pockets formed on the top part of the piston may be eliminated by venting your cores and using less binder in making them. We find the sample core you submitted to us for inspection is rather hard.

An ideal core must be strong enough to remain intact until the casting sets, after which it should burn and crumble. We suggest that you add coarse-grain silica sand to the sand which you now are using, in equal proportions and just sufficient oil to make a suitable binder. Avoid the use of core wash if possible. The core must not be damp when placed in the mold, as the tendency for such a core is to harden during the pouring and cooling period. In making the mold, avoid the us of blackings for facing, rather using the mineral facings and see that the mold is not rammed too hard and is well vented.

Use every means possible to give freer vent to the core and mold to permit an easy exit for gases generated in the pouring, as we are of the opinion that this is the cause of the trouble.

It is essential in making pistons that the iron be poured as hot as possible into the mold which must be well vented to eliminate with ease any gases formed at the time of pouring. Where such castings are submitted to rigid inspection and a small flaw is sufficient cause for rejection, extra care must be taken all along the line in production to eliminate as far as possible the resulting high percentage of defective castings.

Acquire Chicago Heights Manufacturing Plant

G. H. Jones, president of the Hillside Fluor Spar Co., has taken over and recapitalized the Mid-West Forging Co., with works at Chicago Heights, which was under the direction of his son, Harold C. Jones, up to his death some time ago. Mr. Jones has become president of the Mid-West company and Jay L. Hench, who has been associated with Mr. Jones in the Hillside company has become vice president. R. C. Rowan continues as general manager.

Describes Bell Founding-II

Exacting Methods Employed in the Founding of Bells Illustrating the Particular Process of Sweeping Up the Cores in Special Flasks to Insure Satisfactory Castings

BY WESLEY LAMBERT AND G. HALL

MODERN practice in the art of founding large bells follows on the lines adopted by the old bell founders. In ancient times there was a firm belief that bell founding was one of those crafts the mysteries of which were handed down from father to son. The mysteries have vanished, and the art of bell founding is now well within the scope of experienced loam molders, irrespective of parental ancestry. Nevertheless, as is only to be expected, large bells of good tone bearing long cast on inscriptions and much artistic ornamental work, are most often the product of firms specializing in this class of foundry work. Naturally, the modern bell founder, not having to face any great difficulty regarding the transport of his heavy castings, establishes a well equipped foundry replete with a suitable range of equipment and accessories to meet the requirements of his various customers. In addition, a designing department, pattern shop, and machine shops also are included in the modern bell founding works.

With the foregoing facilities for output, it is customary, whenever possible, to cast a complete peal of church bells from one and the same cast of metal, use being made of one or more ladles to hold the metal when the furnace or furnaces are tapped. Should the weight of metal to be melted for the complete ring of bells exceed the capacity of the furnace, as sometimes happens, the cast must be divided, care being exercised to ensure that the metal of subsequent casts are of the same composition and poured approximately at the same temperature.

Working drawings, with an estimate of the weight of each bell in the cast condition, are prepared in the designing department and passed on to the patternmaker. The working drawings are usually made full size, thus obviating any error in setting out the curves of the bell, these curves being an all important factor in determining the thickness and subsequent tonal results of the finished bell. The working drawings are often prepared on thin paper, thus enabling the patternmaker, by placing carbon sheets between the wood and the drawing, to trace the lines direct upon the wood by means of a stylus. The lumber used by the patternmaker for the sweep board, etc., must be of a hard nonporous character and well seasoned, otherwise, owing to distortion of the wood, unequal thickness and distorted shapes will be evident in the castings. To overcome such defects is not only costly but requires considerable skill on the part of the mechanic whose job it is to prepare the bell for tuning.

Two sweep boards are required for each bell mold; an outside board for striking-up the exterior, and an inside board for striking-up the core. Both boards must have well finished sharp edges, and notches are cut in each board to indicate the positions at which sizes are determined by the aid of size sticks. These latter are supplied by the patternmaker, and must be protected from injury when in use. The sweep boards and other parts made by the patternmaker are checked by a draughtsman before being passed on to the foundry. In general practice it is now usual for the mold for the heaviest bell—known as the tenor bell—to be started in advance of the others, and the subsequent molds are proceeded with in order of weight of bell to be cast. The reason for this is obvious, if all the bells are to be cast from one charge of metal, the heavier the bell to be cast the longer the period required to prepare and dry the mold in order to have all ready for pouring on the same day.

The actual operation of molding proceeds on the following lines. Use is made of a heavy baseplate, permanently

FIG. 4—PREPARING THE VARIOUS SIZE MOLDS AND CORES FOR A CHIME OF BELLS

fixed on a concrete bed on the foundry floor and having three raised sides, which are machined level, upon which stands are placed serving as stools for the bell case. In the center of the base-plate is a conical pin upon which the bottom end of the spindle rests. The top end of the spindle fits over a similar pin which is fixed in a strong cast-iron bracket projecting from the foundry wall or a column. The spindle is made of round steel, and is machined over the entire length. The projecting bracket is mounted on a pivotal pin, and by this means it can be swung away from the mold on the completion of the molding operations. Attached to the spindle is a bar which serves to carry the sweep boards, these latter being bolted into the desired position. The striking-up of the mold portion forming the outside of the bell surface differs somewhat from the usual practice followed in ordinary loam molding. A cast iron bell case casting, not unlike a bell in shape, is employed in lieu of the usual brickwork and binders. These cases are usually about six inches larger in internal diameter than the external diameter of the bell to be molded, thus allowing for a generous thickness of loam in the mold proper. The bell case castings are provided with trunnions for lifting and upending purposes. These trunnions are essential, as the portion of the bell mold in question is molded the reverse way up, that is to say mouth upwards, and it is reversed in the completed mold as assembled for casting.

The case is placed on the three stands and carefully squared and lined to the appropriate sweep board which is in position on the arm of the spindle. Loam cakes, previously molded and thoroughly dried, are cemented with a clay wash to the inside of the case. The first rough coat of loam is plastered on over the whole surface of the cakes, use being made of the sweep board and the necessary care being taken to leave a sufficient space for a second or final coat. The case is then placed in the drying oven where it remains until the mold has become thoroughly dried. In like manner all the other mold cases for the complete set of bells to be cast are prepared and dried. The drying oven equipment usually includes various sizes of trolleys or carriages, and each case is placed upon a separate carriage. Due regard is paid to the position of each case in the oven, and also economy of floor space, in order to utilize to the best advantage the full oven capacity. As soon as the rough loam coating of a mold is thoroughly dry, the case is returned to the base plate and again leveled and set as accurately as possible to the sweep board. Measurements are checked, and the final coat of loam is applied. The loam used for this final coat must be well ground and of a fine and smooth texture, fairly free from clay. Sowhair cometimes is used in admixture with the loam to ensure the necessary binding. The final coating of loam as applied to the mold must be as thin as practicable and should rarely exceed three-eights of an inch in thickness, otherwise contraction cracks will develop in the mold during the final drying, and unsightly veins will be found on the surface of the subsequent casting from the mold. Such veins may seriously detract from the appearance of the lettering and ornamental work with which many bells are embellished.

FIG. 5—FINISHED CORE FOR LARGE BELL

FIG. 6—ASSEMBLING MOLD FOR LARGE BELL

The final coat of loam having been applied to the mold and carefully swept the mold in its bell case is returned to the drying oven and thoroughly dried, great care being taken that the mold is not scorched or burnt during this operation. The mold is then taken from the oven and when cold, is checked for size by an experienced molder. When the molder has satisfied himself that the mold is correct he proceeds to apply a wash of blacking to the surface of the loam. A satisfactory blacking mixture for this purpose is made up by an intimate admixture of 60 per cent of charcoal blacking, 30 per cent of plumbago, and 10 per cent of china clay.

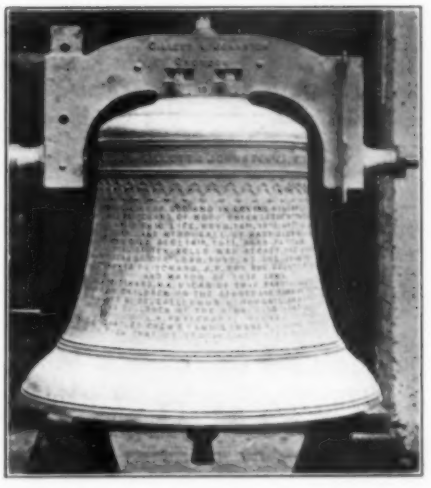


FIG. 7—BELL ON WHICH APPROXIMATELY 1000 LETTERS ARE CAST

After carefully sleeking the surface of the blacking to a smooth finish, the mold is lined and set out to receive any ornaments or inscriptions which have to appear on the bell when cast. As many as 500 to 600 letters appear in some of these inscriptions, and as many as 200 letters are quite common. Each letter or numeral is stamped into the mold separately, this work, including the stamping of the ornaments, being done while the mold face is still soft after the application of the blacking wash. The inscription is carefully checked as soon as the whole is completed, and if found to be correct, the mold is dried off by the heat from a small brazier placed under the mouth of the bell case. Fig. 7 shows a bell bearing nearly 1000 letters besides ornamental work cast on the surface. The letters are 1¼ inches and ¾ inch, and stand out in relief about ⅛ inch. More than 2500 letters appear on the complete set of eight bells.

At the same time that one gang of molders is preparing the set of cases or outer parts of the bell molds, another gang is preparing the cores or inside parts. The sweep arm for working-up this part of the mold is similar to that previously described. A circular base plate is used upon which the core is built, the diameter of the plate corresponding to the diameter of the outer flange of the bell case. Bolt holes in each part serve subsequently to secure each part to the other when the complete mold is assembled. The sweep board of exact shape to that of the desired interior of the finished bell, is then fixed into position on the sweep arm, and the core is built of brick and loam in much the same way as any ordinary loam

core of a similar type is commonly constructed. Should the core be intended for the mold of a large bell, a binder of cast iron is built into the top of the core. The same practice is followed in the drying and final coat of loam, blacking, etc., on the core, similar in preparing the outer portion of the mold. Special care and attention must be given to forming the top of the core for the reason that bells are cast from the top with the mouth of the bell towards the floor. Unless the top of the core is well made and free from cracks, a scab or a fracture may result, and the subsequent casting may be judged a waster.

In assembling the completed parts of the mold no setting out or marking off is entailed, as is so often the case in loam molds, provision being made for this in the actual molding. Both the sweep board for the outer case and for the core have a tapered seating. For a large bell the seating would be about 2 inches. wide. The bell case is carefully lowered by the crane over the core until resting just above the seating. When in such a position the suspended part is gently and carefully rubbed by a rotary motion until when the bell case is finally lowered a perfect joint is secured.

The mold for the largest bell of the set having been assmbled and bolted, it may be sunk to a depth of a few feet into the foundry floors. A runner box is then fitted and bolted into position. To bring the runner boxes of each mold to about the same level one with another, provision is made for bolting a box on to a flange carried on the bell casing. A plug runner is used with a down stem of about two inches for large bells, and a small riser or flow to denote when the mold is full of metal.

Modern bell founders prefer the reverberatory type furnace for melting the bell metal. This type of furnace insuring better control over the mixing and

FIG. 8—BUILDING UP CASING FOR LARGE BELL MOLD

the subsequent alloy, and, the whole of the metal required can be melted in one heat. The temperature of the bath of metal is ascertained from time to time by a pyrometer. With the exception of extra large bells, all castings are removed from the molds on the day following the cast. The core having been dislodged, the bell is brushed over with wire brushes and is then submitted to a critical inspection, checked for size and thickness, and tested by the turner as a preliminary measure before proceeding with any further work on the casting. The bell having passed this first inspection, it is fettled and cleaned up by filing, after which it is subjected to a process of cleaning by sand or shot blast. The casting is again inspected, and if found satisfactory the bell is passed on to the machine shop. The second inspection and passing of the casting removes any anxiety the foundryman may have had as to whether the casting was a success or a waster. The inspection after sandblasting serving to discover any casting defects of a serious character.

In general foundry practice little or no public ceremony is attached to the actual casting operations; this, is not always so in the bell foundry. The occasion upon which a peal of bells is to be cast is often made a ceremonial day, and regarded as an auspicious event. One can leave to the imagination of the reader the incongruous atmosphere in which some of the visitors who assemble in the foundry find themselves on such an occasion, and also the effect upon the nerves of both the visitors and management, if for any reason the tapping of the furnace is delayed long past the appointed time.

FIG. 9—ILLUSTRATES VARIOUS STEPS IN BELL MOLDING

Publish Data on Alloys

The Crucible Steel Co. of America, New York, has issued a 21-page booklet dealing with its non-corrosive and heat resisting iron and steel. This booklet is intended for architects, chemists, metallurgists, engineers and manufacturers and all those interested in the use of materials of a non-corrosive character. Non-corrosive steels may be classified in two groups. The first includes those which can be hardened and heat treated similarly to carbon and alloy steels. This division also includes primary stainless iron and stainless steels with 9 to 16 per cent chromium. Stainless steel runs approximately 0.30 per cent, carbon and stainless iron contains a maximum of 0.12 per cent carbon.

The second group of non-corrosive steels for the most part is composed of chrome-nickel alloys with a high chromium and nickel content and small additions of other elements to produce required results. Those are referred to as non-hardening steels.

While the tensile strengths of the high chrome-nickel-silicon steels are not great, the alloys retain their physical properties to a great degree at elevated temperatures In this respect they differ sharply from the ordinary carbon and alloy steels which weaken rapidly at high temperatures.

A.S.T.M. To Meet in June

The executive committee of the American Society for Testing Materials at its recent quarterly meeting decided to hold the 28th annual meeting of the society at Atlantic City, N. J., June 22-26, 1925, with headquarters at the Chalfonte-Haddon Hall hotels.

The Mt. Vernon Car Mfg. Co., Mt. Vernon, Ill., has awarded a contract for 1850 tons of structural steel for a new straight line foundry. The foundry has been contemplated for several years and now is going ahead. Neiler, Rich & Co., 431 South Dearborn street, Chicago, are the engineers.

Melting Copper in the Cupola

Detailed Description Is Presented of the Methods and Materials Employed To Secure Sound Copper Castings from Metal Melted in a Cupola Designed To Melt Iron

BY T. F. JENNINGS

CONSIDERABLE difficulty usually is experienced by foundrymen who attempt to cast copper in sand molds owing to the partiality of the metal to absorb gas from the air and from the fuel while in a fluid condition and at a high temperature. Gas remaining in the metal after it has solidified produces a spongy structure that renders the casting unfit for use. This condition is so prevalent that the minds of many foundrymen are prejudiced in advance against any attempt to melt the metal, a prejudice that is entirely unjustified if proper precautions are observed. Copper castings can be produced just as easily and as readily as castings in iron or any other metal if certain fundamental factors, peculiar to the metal while in a molten condition are taken into account. Copper is tougher than iron and can be made quite hard and in the opinion of the writer approximately 50 per cent of so-called acid resisting castings now made from cast iron should be cast in copper.

Blow holes in copper castings sometimes are due to wet or hard molds or cores. The remedy for this defect is obvious and presents no particular difficulties. However, the great majority of spongy copper castings are due to conditions that develop during the melting period. Copper, like a number of elementary metals and some alloys, when raised to a temperature of over 1000 degrees Cent. will absorb a certain amount of gas which has to be expelled in some manner before the metal is poured into a mold and allowed to solidify.

The usual method of accomplishing this result is to add some material to the bath that has a greater affinity than copper for the gas. Oxygen is the scapegoat usually held responsible for the porous condition of the metal and therefore the fluxes used to clarify the metal are known as deoxidizers. Without any direct proof in support of the contention the author still is of the opinion that sulphur is to some extent responsible for porosity in the metal. Sulphur and oxygen unite to form sulphur dioxide and if this generation takes place in the molten metal, the gas will be retained and form cavities in the casting. Irrespective of the identity of the gases responsible for the trouble it is apparent that gas in some form is present and therefore it is essential that the molten metal shall be protected from contamination, both from sulphur and from oxygen

Types of Furnaces

On account of the comparative ease with which copper may be protected under a covering of charcoal, or some form of fluxing material, many foundrymen favor a crucible as a melting medium. This is particularly true where the metal is melted in a natural draft furnace using coal or coke for fuel. With a gas or oil fired crucible furnace the problem of protecting the metal is a little more difficult. The force of the flame will blow the charcoal covering from the surface of the metal. On a furnace of this type it is advisable to use a flux that will melt and form a protective coating over the molten copper. This feature makes the problem still more complicated when melting copper in an oil or gas fired noncrucible furnace. In this case the flame comes into intimate contact with the metal. Theoretically the electric furnace would seem to offer an ideal medium for melting copper, since it may be worked open or closed.

Among foundrymen, the cupola furnace primarily designed for melting iron, has the most unsatisfactory reputation of the many mediums used for melting copper or any of the nonferrous alloys. The metal, fuel and air blast are in intimate contact during the entire melting period. Many foundrymen are convinced firmly that satisfactory nonferrous metal cannot be secured from a cupola.

The writer has had considerable experience in making light and heavy copper castings from metal melted in a cupola. The following details of the methods employed may be of interest since they deal with castings that in some instances weighed 5000 pounds, with walls from 3 to 5 inches in thickness and which as a last step were machine finished all over on the outside.

The metal for copper castings is melted in the smallest of our four cupolas lined to 32 inches and of the standard type made by the Whiting Corp., Harvey, Ill. With a few minor modifications the cupola is prepared, charged and tapped in the same manner as when it is engaged in melting iron. The wood employed for kindling the coke is examined carefully to prevent the entrance of any nails. This is a nonessential feature in iron melting practice, but is touched upon here because it is one of the many little features essential to the success of melting copper. Also, it is one of the little things so easily overlooked.

The copper is charged between layers of charcoal to protect it from the sulphur in the coke. Usually the entire amount charged is 15,000 pounds and with a mild blast of about 8 ounces, the heat is run off in an hour or a little more. The metal charges which are made up in great part of scrap copper wire weigh 1250 pounds each. The 600-pound coke bed is covered with a 45-pound layer of charcoal and the copper charge of 1250 pounds is laid on the charcoal. A similar layer of charcoal is placed over the copper. This is followed by the charge of coke, 60 pounds and another 45-pound layer of charcoal. The second charge of copper, 1250 pounds is placed on the charcoal and the same procedure is followed until the entire amount for the day's heat is charged.

After the metal is melted it is tapped into a ladle of suitable size for the work in hand. An oil torch is employed for about 30 minutes to bring the ladle lining to a red heat before the metal is tapped into it. A quantity of calcium chloride amounting to approximately 0.50 per cent is placed in the bottom of the ladle about 10 minutes before the metal is tapped. The calcium chloride melts and floats on top of the metal where it forms an air tight covering. The object in placing it in the heated ladle before the metal is tapped is to drive off any water which may be present either as water of crystallization or as moisture absorbed from the atmosphere.

A generous layer of charcoal also is placed in the bottom of the ladle before the metal is tapped. The charcoal

---

From a paper presented before the American Foundrymen's association at the convention held in Milwaukee Oct. 13-16, 1924. The author is foundry superintendent the Utah Copper Co., Garfield, Utah.

forms an additional covering for the metal and also serves to retain the heat. Usually a small quantity of silica sand is sprinkled over the surface and then stirred in to stiffen the slag and prevent it from flowing with the metal.

Phosphor copper to the extent of 1.00 per cent with a phosphorus content of 15 per cent is used as a deoxidizer. Usually the metal is handled in a 5-ton ladle which is filled in three taps. The phosphor copper is added to the metal after the first tap and is prevented from evaporating by the close fitting slag cover. The two following taps help to distribute the phosphorus through the entire metal mass without having recourse to the mechanical process of stirring or poling.

To minimize as far as possible the annoyance caused by the smoke and fumes incident to handling such a large quantity of copper, we usually arrange to bring the metal down immediately after the regular quitting time. By this arrangement only a few men remain in the shop and we also are assured of rapid and uninterrupted crane service. The metal is transported rapidly to the molds and is poured at a temperature of 1950 degrees Fahr.

The metal is poured at the speed ordinarily employed for pouring castings in iron of the same size and shape. The stream is slowed down before the mold is filled and the remainder of the mold is filled slowly. A small piece of phosphor copper is placed in each large riser and the metal is churned until it solidifies. Hot metal from a small oil fired furnace operated for the purpose, is used to keep the risers filled and to compensate for the shrinkage.

Fill the Pouring Basin

We have found it advisable in pouring heavy copper castings to keep the pouring basin full so long as the mold is taking metal. A considerable degree of care and skill are required both in the arrangement of the gates and the manner in which the metal is poured to prevent the metal from carrying entrapped air down with it into the mold. Under certain conditions the air is held in temporary suspension in the metal and later in its attempt to escape causes the metal to swell up in the risers.

To secure sound copper castings the melting process must be conducted in a careful and skillful manner with any type of melting furnace and this applies particularly to the cupola. If castings are required to present high electrical conductivity it will be necessary to omit the phosphor copper and provide some other agent for the elimination of occluded gases. The writer has had no experience on these castings and is not prepared to submit a solution for a problem of that character.

Brass castings may be poured successfully from cupola melted metal if the proper precautions are observed. The copper is melted in the manner described and the zinc is added in the ladle. To obviate any chilling effect the zinc is heated almost to the melting point before it is added to the copper.

Many of the copper castings are made in dry sand molds. An open facing is used made up of half molding sand and half sharp sand bonded with core compound in the proportion of one part compound to 20 parts sand. Neither sea coal nor blacking is used on the mold on account of the tendency to produce sulphur and gas. The rammer never is allowed to approach nearer than one inch to the pattern and the molds are vented thoroughly and carefully. For heavy copper castings the molds invariably are dried and poured from the bottom. Suitable gate cores are employed to convey the metal to a point near the bottom of the mold.

Copper castings required to resist the action of acid or to possess hard wearing qualities have been treated with from 2 to 4 per cent of an alloy composed of 16 per cent chromium, 1 per cent phosphorus and 83 per cent copper. This alloy is prepared in a crucible steel melting furnace in which the chromium is melted first on account of the high temperature involved in melting this material.

Large and small copper castings usually are made in sand molds either green sand or dry sand, but iron molds sometimes are employed for casting electric furnace terminals in which heavy copper cables are bedded.

What An Apprentice Thinks

(*Concluded from Page* 919)

corded during the first month will take on a different aspect at the end of six months or a year. The important phases gradually will work out, such as the principles underlying certain molding practices, and may be recognized as facts. Now and then on a re-reading one will find places where some friend unloaded a lot of bunk. Sometimes it is not too late to get even. Then as improvements over existing conditions work themselves out in one's mind, there is no better place to dispose of them than within the pages of a note-book until they have had a chance to season or die a natural death.

A student apprentice, if working in a modern foundry under the supervision of an interested management, has an opportunity to acquire a valuable industrial education. During the time he is in training, he should endeavor to acquire as much as is possible of the useful knowledge gathered from years of experience and existing among the men on the floor as a sort of lore. The successful combination of this information with whatever technical training he may possess should fit him for a responsible, and in some ways a unique, position in the foundry industry.

Discuss Cupola Practice

At the opening session of the Birmingham branch of the Institute of British Foundrymen, Prof. A. Campion, Glasgow, gave a lecture on modern cupola practice. The lecturer, who is a recognized specialist in cupola research, stated that the cupola represents the simplest form of working apparatus and has been little change by the modifications introduced at various times. For successful practice the great essential is to get complete combustion and the utmost utilization of the heat in melting the metal. The amount of air admitted to the cupola often is in excess of what is required. It is possible to melt 2000 pounds of iron with 175 pounds of coke.

Iron Buyers Meet

Tool steel and scrap specifications were discussed at the meeting of the National Association of Purchasing Agents' iron and steel committee held in the offices of the purchasing department of the National Malleable & Steel Castings Co., Cleveland, Oct. 17. It was decided to carry to completion the work started by the committee last year on the formulation of a standard contract to govern the purchasing of scrap. The committee discussed the request of the American Society for Testing Materials to consider its tentative standards for carbon tool steel and high speed steel. It was voted to refer such tentative standards to representative buyers of tool steel.

Those present were George C. McClure, American Rolling Mill Co., Middeltown, O.; W. W. MacMillen, National Malleable & Steel Casting Co., Cleveland; L. W. Brice, Continental Motors Corp., Detroit; E. W. Kruger, Union Bed & Spring Co., Pittsburgh; H. C. Wicklin, Union Steel Castings Co., Pittsburgh; A. G. Ropcraft, Ferro Machine & Foundry Co., Cleveland; Russell Forbes, secretary, National Association of Purchasing Agents.

Forms Large Copper Crystals

Gradual Heating and Cooling of Pure Copper in an Electric Furnace Is the Secret of Success in Producing Large Size Crystals Giving Peculiar Physical Properties

COPPER bars that can be bent double with one finger but which require strength to straighten again are expected to lead to a greater understanding of the properties of metals. The bars, which are really single crystals of pure copper, were produced in the research laboratory of the General Electric Co., Schenectady, N. Y., and have been subjected to many kinds of examinations and a number of interesting results have been obtained.

Knowledge of the properties of metals has been limited in the past to observations of masses of small crystals. The usual piece of metal is a conglomeration of small, closely packed crystals, with the crystalline structure usually apparent at a glance. Zinc is known as a brittle metal, a rod of it can be bent but slightly without snapping. Investigations of small single zinc crystals show that any one crystal of the metal can be drawn out to six times its length in one direction; in a different direction it is extremely brittle. The properties of zinc depend upon how the crystal is examined, whether with the grain or against it. The usual piece of zinc really is a collection of small crystals pointing in all directions, so that the properties are the combined qualities of the small crystals in the different axial directions. The same holds true for other metals and other substances.

A single crystal of copper ⅞ inch in diameter and 6 inches long, as well as numerous small crystals of the same metal, have been produced by Dr. Wheeler P. Davey of the research laboratory. These crystals, obtained by a modification of the method devised by Dr. P. W. Bridgman of Harvard university are much larger than any previously recorded. Gradual heating and cooling of pure copper in an electric furnace is the secret of the success in producing them. The necessary amount of pure copper, in the form of a bar was placed in a closed, cylindrical carbon crucible, and slowly passed through the electric furnace. If molten metal is cooled quickly, the resultant mass is composed of small crystals; if the melt is cooled slowly, the crystals are larger. Dr. Davey cooled the melt so slowly that only one crystal was produced, and that included the entire melt. The atoms had plenty of time in which to arrange themselves as they desired to build up a single crystal rather than a multitude of small ones.

FIG. 2—A LARGE COPPER CRYSTAL MAY BE BENT WITH EASE

Several interesting results have been obtained with the large crystals. A piece of about the size of a lead pencil, if given a jerking motion, bends as easily as does a stick of soft wax. However, it cannot be sent back, any more easily than a similar piece of ordinary copper. When the copper is a single crystal, all of the atoms are arranged in columns, equally spaced. When the bar is bent, the spacing is changed, the atoms on the inside curve are pressed together, and those on the outside are spread apart. Strains are set up and the crystal structure is altered. The bar becomes an ordinary piece of copper, of small crystals facing in all directions.

If the surface of the large crystal is nicked or dented, the structure in the neighborhood is changed. It is similarly affected by filing or polishing. When one of the bars is polished it is necessary to take off a mill or less at a time, even then the structure of the new surface is altered. The condition is remedied by etching away the surface with the usual acid bath.

An etched bar of the copper appears to be rough, showing alternate dark and light lines. The appearance of the lines is due to the acid etching more easily in some directions than in others. The directions in which it etches with the greatest difficulty are parallel to the axes of the crystal.

Externally the large, single copper crystals differ little from the usual metal.

However, X-ray analysis, furnishes conclusive evidence that such a crystal has been produced. Dr. Davey, by special apparatus, was able to prove that he had one crystal. In the usual examination a small tube of finely powdered crystalline material is placed in the path of a narrow beam of X-rays of a specified wave length. The substance turns the X-rays in different directions, according to the arrangement of the atoms in the minute crystals. When photographed, a series of lines is produced on a photographic film, and these lines are used in calculations which reveal how the atoms are arranged and how far apart they are. Copper crystallizes in the face-centered cubic system. The atoms are arranged at the corners of an imaginary cube, with another atom in

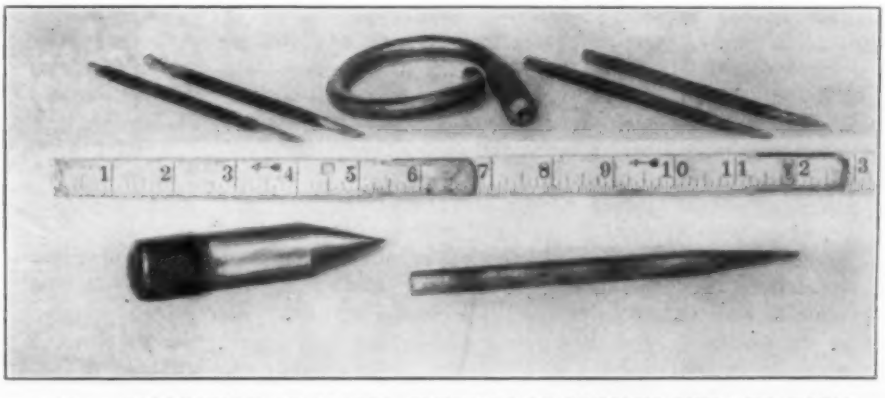


FIG. 1—COLLECTION OF COPPER CRYSTALS OF VARIOUS SIZE AND FORM

the center of each face. In studying the single crystal Dr. Davey revised the method of examination so that the large crystal was used, rather than crystalline powder. The specimen was swung slowly back and forth through an angle of 30 degrees, with the edge in the path of the X-rays. The rotation of the single crystal produced the same effect as using a stationary powdered sample, and a pattern was received on a stationary film. At the same time a moving film was used, mounted on the turntable with the crystal. If the specimen had not been a single crystal, no lines would have been obtained on the movable film, since the X-rays would have affected the entire film uniformly. The lines were obtained, and calculations based on a comparison of the two negatives showed that the axis of the crystal was parallel with the direction of cooling the ingot.

How and Why in Brass Founding

By Charles Vickers

Phosphor Copper as Flux

We desire to learn the correct order of adding metals in making a mixture of copper 85, *tin* 5, *lead* 5, *and zinc* 5 *per cent and why? Is it an advantage, or a disadvantage to use phosphor copper for fluxing the above alloy when a commercial flux of covering is used in melting. When charcoal is used as a cover at what period of the melt, should it be added? Does charcoal act as an insulator and prolong the melting period? What constitutes a mold? Should the entire sand project, including the cavity left by the pattern be called a mold? Is the word cavity to indicate the opening left by the pattern, correct? If the cavity is the mold proper, how should the flask of sand be referred to?*

There is no order of adding the white metals to form alloys of copper of the red brass class, that is recognized as *correct.* Usually the zinc is added first, and the tin last, but this order may be reversed. Some foundrymen consider the zinc to be the logical metal to add first, because it will deoxidize the copper. The tin is added last because it is the more expensive metal and it is thought best to sacrifice the cheaper metals as deoxidizers. It is doubtful, however, if there is anything in such a theory, as it is simply a choice of which oxide shall be substituted for the cuprous oxide dissolved in the molten bath. Zinc oxide is volatile, but when a small amount of zinc is added to copper, the zinc oxide substituted for the cuprous oxide remains in its original state, and only ascends tc the surface of the metal very slowly. The same is the case with lead and tin. It makes no difference how the white metals are added in ordinary prcatice but if the cuprous oxide is reduced within the copper before the white metals are added then the substitute oxide is then removed whatever it may be, and there will be a very great difference in the physical properties of the metal.

(2) Usually it is not necessary to add phosphorus to red brasses after they have been melted under a covering such as a flux, but if two ounces of phosphor copper are put into the crucible with the copper, for each hundred pound heat, it will improve the alloy as it reduces the cuprous oxide before the white metals have a chance to do this work. (3) Charcoal should be added (in crucible melting) with the copper, or as soon as possible afterward. Blocks of hardwood are to be preferred to charcoal as the gases from the burning take up free oxygen that is atmospheric. (4) No. (5) The entire flask with accessories such as bottom boards. (6) Matrix, would probably be a better word to use than cavity.

Eliminates Yellow Cast

We melt considerable nickel silver which after being polished and let stand a while, takes on a yellow cast. Is there anything we could add to the alloy that would do away with this trouble. We would like to obtain a mixture for a good coil spring brass.

The white color of the nickel silver is produced by the nickel; obviously as nickel is the expensive metal, the higher the percentage of nickel used the higher the cost of the alloy, and the whiter and better it will be. Without nickel such alloys would be simply yellow brass and if the nickel is too low, after standing the yellow will show through although when first cut the alloy looks white. An alloy much used contains 15 per cent nickel; 35 per cent zinc, balance copper, with possibly a little aluminum as a flux. This alloy will show yellow after it is cut, and this can be prevented by increasing the copper, and nickel, and decreasing the zinc; thus an alloy of copper 62 per cent; nickel 18 per cent; zinc 20 per cent, will not show yellow after machining. The above alloy can be modified by adding lead, iron, and tin, deducting the lead from the zinc, and the tin from the copper.

For a brass coil spring use the following alloy; copper 69 per cent, zinc 30 per cent, tin 0.25 per cent, manganese copper 0.25 per cent, iron 0.50 per cent. The manganese copper should contain 30 per cent manganese; the iron should be in the form of loosely coiled tin plate. Melt the manganese copper with the copper under charcoal and when very hot add the tinplate, pushing it under the fluid and stirring very thoroughly then add the zinc and finally the tin.

Zinc Alloys Iron

We are melting an alloy of zinc 80 *per cent, aluminum* 15 *per cent, copper* 5 *per cent in a cast iron kettle* 12 *inches in diameter, and which holds* 20 *pounds of the alloy.. The pot is heated by gas burners, and the molten metal is dipped out by use of a small ladle from which it is poured into the permanent molds. We find considerable loss due to dross while melting and pouring, which consumes one and a half hours. Salt and salammoniac are used for fluxing, but we never get the last* 20 *per cent of the metal in the pot sufficiently fluid to pour no matter to what temperature it is heated. The metal is poured at a temperature just below redness.*

The *thickness* of the zinc at the bottom of the kettle is due to its having alloyed with iron during the process of melting. This may be determined by analysis. The treatment should be first a preventive one. Use nothing but high grade, iron-free zinc; empty the kettle each time before starting another heat; and before starting up the kettle each morning, coat the inside with a cream of lime, and keep the kettle walls clean. The *thick* zinc may be refined at intervals by potassium cyanide, sulphur and steam in practice, leather scraps are used as a source of cyanide and chopped potatoes to generate steam. These three things, leather scraps, sulphur and chopped potatoes are mixed and a portion enclosed in a perforated container attached to a long handle, and this is immersed in the thick zinc. Only a small

Cut to this point

TYPICAL ANALYSES OF MISCELLANEOUS COMMODITIES USED IN FOUNDRY PRACTICE

By J. M. Quinn

(*Continued from Data Sheet No. 550*)

	Titanium Oxide TiO_2*	Silica SiO_2	Iron Fe		Alumina Al_2O_3	Calcium Oxide Ca O	Magnesium Oxide Mg O	Sulphur S		Manganese Mn	Phosphorus P		
Scums from Ingot Tops													
Acid Bessemer Pipe Steel	.....	7.95	.....	.....	.....	.....	.....	2.51	.....	38.66	0.043	.....	Hibbard—*The Iron Age*, May 29 1919
Acid OH Boiler Steel	.....	20.38	15.96	.....	4.00	.....	.....	0.39	.....	48.50	.....	.....	Hibbard—*The Iron Age*, May 29 1919
Basic OH Boiler Steel	.....	17.14	15.35	.....	15.08	.....	.....	.....	.....	36.00	0.030	.....	Hibbard—*The Iron Age*, May 29 1919
Basic OH Boiler Steel Open Molds	.....	19.70	11.65	.....	.....	.....	.....	.....	.....	40.36	.....	.....	Hibbard—*The Iron Age*, May 29 1919
Basic OH Boiler Steel	5.50	16.80	15.20	.....	3.05	5.04	1.80	0.06	.....	37.57	0.020	.....	Hibbard—*The Iron Age*, May 29 1919
Basic OH Boiler Steel Covered Molds	0.60	24.20	16.10	.....	13.50	1.20	.....	0.10	.....	30.70	0.020	.....	Hibbard—*The Iron Age*, May 29 1919

*This came from the addition of 2½ lbs. Ferro Titanium to the ton of metal.

Commodity	Name Symbol	Graphitic Carbon GC	Combined Carbon CC	Manganese Mn	Sulphur S	Phosphorus P	Silicon Si	Molybdenum Mo	Chromium Ci	Vanadium Va	Tungsten W	Cobalt Co	Nickel Ni	Source of Data
MISCELLANEOUS MATERIALS—(Continued)														**MISCELLANEOUS MATERIALS—(Continued)**
Iron—Gray Cast—Machinery		3.10	0.40	0.45	0.090	0.400	2.25	.....	.....	.....	.....	.....	.....	Merten—The Blast Furnace & Steel Plant, April 1922
Iron—Malleable (before Anneal)		0.34	2.95	0.56	0.050	0.150	1.04	.....	.....	.....	.....	.....	.....	National Malleable Casting Co., Chicago 1918
Iron—Malleable (after Anneal)		2.50	0.01	0.20	0.060	0.200	1.00	.....	.....	.....	.....	.....	.....	Merten—The Blast Furnace & Steel Plant, April 1922
Iron—Synthetic Pig (Electric Fce.)		2.16	0.47	0.84	0.022	0.060	2.28	.....	.....	.....	.....	.....	.....	Wilkinson—The Foundry, February 15 1922
Semisteel (Die Liners)		2.20	0.80	1.00	0.080	0.130	1.30	.....	.....	.....	.....	.....	.....	Merten—The Blast Furnace & Steel Plant, April 1922
		Iron Fe	Total Carbon C	Mn	S	P	Si	Mo	Ci	Va	W	Co	Ni	Cerium Ce Added / Found
Steel—Cerium (Converter)		.....	0.41	0.82	0.043	0.056	0.42	.....	.....	.....	.....	.....	.....	0.50 / 0.16 Spring—The Foundry, July 1 1922
Steel—Cerium (Converter)		.....	0.36	0.71	0.027	0.051	0.32	.....	.....	.....	.....	.....	.....	1.00 / 0.44 Spring—The Foundry, July 1 1922
Steel—High Speed (Usual)		.....	0.65	0.30	0.010	0.010	0.20	.....	4.00	0.85	17.00	.....	.....	Rettew—*The Iron Age*, July 3 1919
Steel—High Speed (Special)		.....	0.70	0.25	0.016	0.014	0.35	.....	3.75	1.30	17.50	2.50	.....	Hoffman—*The Iron Age*, July 3 1919
Steel—High Speed (Special)		.....	0.70	0.28	0.018	0.016	0.38	.....	3.91	1.33	18.18	....	1.73	Hoffman—*The Iron Age*, July 3 1919
Steel—High Speed (Cast to Cutter Style)		.....	0.93	.....	.....	.....	.....	.....	5.07	1.50	21.02	.....	.....	Howitz—*The Iron Age*, June 26 1919
Steel—Manganese		.....	{0.90 / 1.20}	10.50 / 13.00	Under 0.04	Under 0.06	0.30	.....	.....	.....	.....	.....	.....	Usual Specification, Hadfield's Patent.
Nichrome (Ingots)		.....	{0.05 / 0.15}	5.00	.....	.....	10.00	.....	15.00	.....	.....	.....	30.00	Usual Specification, Driver-Harris Patent.
Nichrome (Castings)		.....	{0.65 / 0.75}	5.00	.....	.....	10.00	.....	15.00	.....	.....	.....	30.00	Usual Specification, Driver-Harris Patent.
Silcrome		.....	{0.40 / 0.50}	0.40 / 0.60	.....	.....	{3.00 / 3.50}	.....	{ 8.00 / 9.00	.....	.....	.....	.....	Usual Specification, Ludlum Steel Co.
Stainless Iron		.....	0.07	0.12	.....	.....	0.08	.....	11.70	.....	.....	.....	0.57	Brown Bayley Steel Wks., Ltd., Sheffield, England 1921
Stainless Steel		.....	{0.20 / 0.70}	0.20 / 0.30	0.020	0.020	{0.20 / 0.30}	.....	{12.00 / 14.00	.....	.....	.....	.....	Firth-Brearly Co., Patent.
Stainless Steel		.....	0.31	0.24	0.020	0.020	0.05	.....	12.75	.....	.....	.....	.....	French—*The Iron Age*, August 17 1922
Stainless Steel		.....	0.28	0.48	0.048	0.008	0.09	.....	20.60	.....	.....	.....	5.76	Edert—*The Iron Age*, August 17 1922
Stellite—1914 Sample		10.06	1.79	0.72	Not Det.	Not Det.	0.78	9.44	26.36	1.00	12.70	34.60	.....	*The Iron Age*, December 26 1918
Stellite—1917 Sample		Trace	1.48	None	0.010	Trace	0.17	None	33.60	None	9.15	55.60	.....	*The Iron Age*, December 26 1918
Cobaltcrom		.....	1.48	0.19	.....	.....	0.80	0.84	13.57	.....	.....	3.66	.....	Baxter—*The Iron Age*, July 3 1919
Ghost Lines in Open Hearth Steel		.....	0.49	1.02	0.116	0.082	0.26	.....	.....	.....	.....	.....	.....	De Mare—*The Iron Age*, June 3 1920
Surrounding Metal		.....	0.49	0.89	0.047	0.030	0.31	.....	.....	.....	.....	.....	.....	De Mare—*The Iron Age*, June 3 1920
Acid-resisting Metal		.....	{0.60 / 1.25}	0.35 / 2.50	0.05	{0.05 / 0.200}	14.00 / 15.00	.....	.....	.....	.....	.....	.....	Dyer—*The Iron Age*, Sept. 8 1921

Continued on Data Sheet No. 553

Cut to this point

Do not cut—Fold along this line for binding

Note—This sheet may be cut along this line and one half folded over on the other to bind in 5 x 7 inch note book.

THE FOUNDRY DATA SHEET, DEC. 1, 1924
Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

NEW YORK PROVIDENCE BUFFALO

WHITEHEAD'S SANDS

Whitehead Brothers Company
ESTABLISHED 1850

Foundry Sands, Supplies and Equipment

Providence, R. I. June 7, 1923.

John A. Penton, Esquire,
The Foundry,
Cleveland, Ohio.

Dear Mr. Penton:

We select THE FOUNDRY as an advertising medium because it is preeminently the periodical of the foundry industry and world wide in scope. This makes it of considerable advantage in the presentation of our products and keeping the name WHITEHEAD before the trade.

Our advertisements have appeared regularly for many years. In fact since the early issues and it is a pleasure to state that during that time the service rendered and co-operation shown have been most satisfactory. You, and the officers of the Company, have assisted in making our subject matter of value.

We take pride, Mr. Penton, in having been identified with the growth of the publication and in telling you so.

With assurances of continued patronage, we remain

Very truly yours,

WHITEHEAD BROTHERS COMPANY

Alfred J. Miller
Treasurer.

AJM/I

portion is immersed at one time to the metal in a state of strong ebullition, but not to throw it around. Use two containers in alternation to keep the metal continually boiling, and in about 15 minutes the iron will be removed. The usual time required is from 15 to 30 minutes, according to the amount of iron the metal contains. Flux the dross with ammonium chloride first, then with zinc chloride and if a deoxidizer is needed, use phosphor tin.

Pouring Brass Bushings in Iron Chills

We are looking for information on the subject of pouring brass into cast iron chills. The castings we made are filled with gas pockets, and we wonder if there is any way of getting rid of them. The castings are locomotive rod bushing brasses, 14 inches diameter, 7 inches long and 2 inches thick, made with a dry sand core through the center. We pour these castings through a gate running through the center of the core.

Prepare the mold as follows: First, clean it thoroughly so the surface of the iron is bright and free of all rust and oxide, then heat the chill gently and coat it with lard oil. Over the lard oil apply a coating of French chalk or plumbago, the latter usually being preferred. Rub on the plumbago until the surface of the iron presents a polished appearance like a stove.

Taking the Temperature of Molten Metal

We have bought an electric pyrometer for taking the temperatures of molten metals and would like to obtain the best casting temperatures for the alloys, especially for 80-10-10.

The casting temperatures will depend solely on the metal to be poured. As a general rule a thin casting will require hotter metal, than a thick casting. It is not possible for anyone not conversant with the character of the castings to be able to give the best pouring temperatures. The sensible way is to make your own tables. Bring the metal to the mold side, permit it to arrive at what is judged as the proper pouring temperature and record it, then pour the mold. If the castings fail to run properly, it is evident then they were poured too cold. If the castings are too rough and show a tendency for the metal to eat into the cores, they were poured too hot. One or two adjustments will give the best temperature at which to pour the castings made in that particular shop.

There is considerable variation in the temperatures given by different authorities for pouring metals thus one states that red brass should be poured at a temperature of 2200 degrees Fahr., while another 2000 degrees. The alloy 88-10-2 should be poured at, or near, 2200 degrees Fahr., according to the researches of Carpenter & Elam, but it is more frequently poured under that temperature. From 2050 to 2100 degrees Fahr. is a good casting temperature for this alloy.

Aluminum bronze should be heated in the furnace to 2200 degrees Fahr., and the pouring temperature for heavy valve bodies is 2000 degrees Fahr. The alloy known as Aterite should be heated to 7200 degrees Fahr., in the furnace and poured at, not less than 2200 degrees. Poured at this temperature and deoxidized with the proper elements, no difficulty is experienced with such an alloy.

Much of the variation given as to pouring temperatures may oftimes be attributed to difference in pyrometer readings, the temperatures given for aluminum bronze and Aterite as above were taken with a new pyrometer, supposed to be calibrated accurately.

Porous Aluminum Disks

We are making some aluminum castings in the shape of a six-inch disk with a chambered hub in the center and we experience much trouble with them leaking at the underside connection of hub and flange. About 50 *per cent of the castings leak, although the metal thickness is a uniform quarter inch, and we pour the molds with metal as cool as will completely run the castings. The principal area of leakage is between the two gates we put on each disk, and it appears the oxide gathers there instead of being distributed evenly throughout the castings. We enclose a sketch of the gating method, and also send a sample casting.*

Both the gates are so arranged that the molten metal shoots across the disk and impinges on the hub core to rebound and produce dross, also desposit any sand or dross it may be carrying. The gating is arranged to obtain the maximum disturbance of the metal upon entering the mold. In the case of aluminum alloy, this is fatal to clean, dense metal. The castings will leak when subjected to slight pressure.

An inspection of the casting leads to the belief that the gates will require changing and one gate would be ample to flow metal to completely fill the mold. Several experiments will have to be made to get the gates correct. One of the first should be to place on a gate that will enter the disk at a tangent to its circumference thus giving the molten metal a spin upon entering. The hub will fill last instead of first; with the hottest metal. The sample casting has been poured too hot such a condition is a most fruitful source of defective castings of aluminum alloy. While the gate is open to criticism, it should do much better than a 50 per cent production loss. It looks as though too many molds were being poured at a heat, making it necessary to pour at the beginning with metal too hot. This is a good way to run up losses, but is a matter that can be easily eliminated. The most satisfactory way of making aluminum alloy castings, is to melt the aluminum in a cast iron pot, then dip out with a small hand ladle and pour a few molds at a time, the temperature of the metal in the melting pot being gaged by pyrometer to allow transference to the molds and arrive at the exact pouring temperature. This is easily adjusted after a few trials.

As 50 per cent of the castings withstand the required pressure which must not be higher than can be expected of a No. 12 aluminum alloy, such being the case all the castings would leak. To be on the safe side the copper may be gradually raised to as high as 14 per cent if the percentage of leakers appears higher than justified.

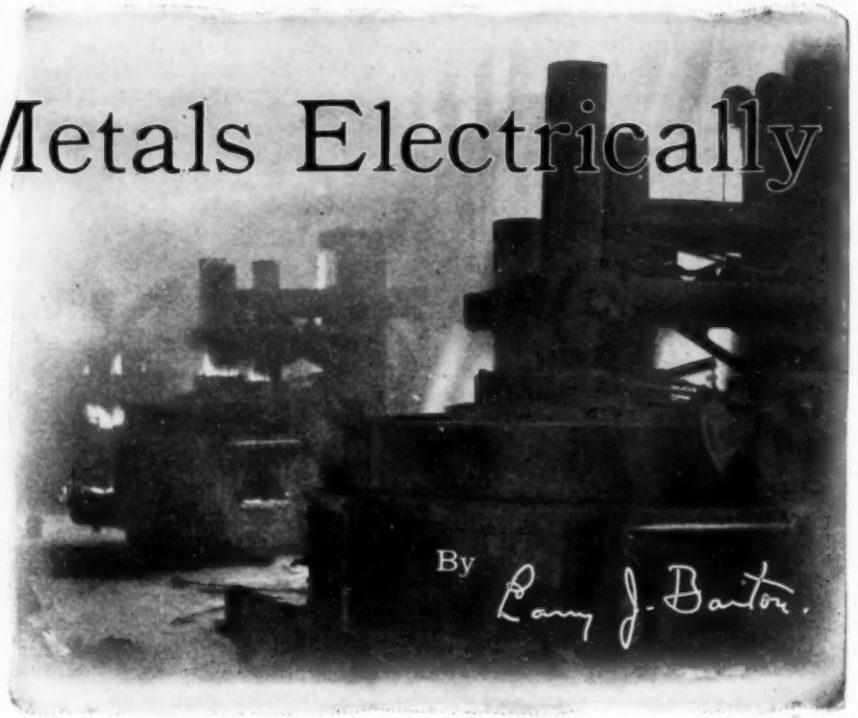
To Obtain Bright Finish

We have recently commenced to make our own castings for fire sprinkler heads, where formerly we bought the castings. We fail to get the bright finish the outside castings carry. The casting which we make are dark-colored, unsightly and rough, in comparison. We experience difficulties in cleaning our castings and will appreciate your suggestions as to how we can remedy this situation.

The outside casting has been finished by tumbling in a water tumbling barrel, such barrels are lined with wood blocks laid with the grain toward the inside of the barrel. The castings are packed in until the barrel is filled and debris from the skimming hearth, added as the particles have a scouring action on the castings. The barrel is then run until the castings are practically polished. Such a tumbling barrel can be obtained through advertisers in THE FOUNDRY. In fact manufacturers of such equipment will probably be glad to suggest the kind of barrel to obtain to produce the best results.

The home-made casting will never tumble to the fine finish of its rival because the metal is not sufficiently clean it contains iron in considerable quantity as shown by analysis; this may be derived from scrap copper, or brass or from one of the other metals. Such a contamination produces the dark colorations; other methods of cleaning are sand-blasting followed by acid dipping.

Refining Metals Electrically



Chapter III (Continued)

One Slag Basic Process Described—Acid Practice Cheap and Rapid

PREVIOUS portions of this chapter have covered basic practice in detail where it is intended to remove both phosphorus and sulphur. A modification of this process finds wide use. A great part of the present day scrap metal is that which has come from the basic, open-hearth furnace and naturally is low in phosphorus. Using such a mixture there is no necessity for the added cost caused by removing any phosphorus, as such metal usually will contain this element in amounts of under 0.04 per cent, and the standard steel castings allow at least 0.05 per cent, giving a sufficient leeway to allow for any pickup due to shrinkage of the charge. Naturally this has resulted in shortening the basic process, known as the one slag process for making steel.

In making metal under the one slag process for basic steel, the scrap is charged in exactly the same manner, but no lime is added with the charge. As soon as the metal begins to melt sufficient lime is added to enable the arc to pull a steady load, and to allow enough of a blanket on the metal to overcome any excessive loss of heat due to radiation. As soon as the heat is almost melted, the steel is given a heavy dusting of coke, and the second slag added exactly as before described, small portions being added consecutively. Coke is added, depending upon the allowable limits for the carbon in the metal. Soon the slag begins to turn from the black to the brown, and all further handling is done as has been described under finishing slags.

There are times, due to a rusty charge, when this small first slag becomes so contaminated with oxides that any attempt to clear it will result only in a long and tedious operation. The best process to follow here is to pour off this slag as soon as possible, and then add the final mixture. This is a good practice to follow under nearly all circumstances, as pouring off this heavily oxidized slag means that there is less oxide to clear in the end, the result being a more rapid running of the heats. As soon as the metal is melted and sufficiently hot to hold its heat for a few minutes, the furnace is tilted and this first, heavily oxidized slag is run off. Such a slag will be thin, and dead black in color and readily will run from the furnace. To obviate unnecessary handling, this slag may be run into a bucket, allowed to cool, and the lump disposed of in one piece. As soon as the greater part of the slag has been removed, the metal will start to run. The furnace is tilted back, the manganese added, and the heat finished in a manner similar to the two slag process where phosphorus is removed.

One Slag Process

WHEN low phosphorus scrap is available, the one slag basic process is applicable. No lime is added with the charge, and a single slag similar to the second in the two slag process is used. When heavily oxidized scrap is charged particular precautions are suggested by the author, who sums up the basic processes and mentions the use of a white slag for high carbon steels. In introducing the acid process for carbon steel, Mr. Barton explodes the fallacy that anyone, no matter how unskilled, is competent to melt steel in an acid lined furnace. He presents the advantages of acid operation, and gives a vivid description of the appearance of the charge during the melting down period.

While such a slag is intended to remove only the oxides and miscellaneous impurities, it also will remove a reasonable amount of phosphorus if handled correctly. For this purpose, the first slag is made of about 2 per cent of the charge, lime, added to the furnace during the melting down period. Under such conditions the first slag will be basic enough to hold a certain amount of phosphorus in combination. It is safe to figure that such a slag will remove from 0.015 to 0.025 per cent phosphorus from a heat containing an average amount of rust, without the neccessity of additional boiling.

In operating under the one slag process, the only great difference will be in the manganese content, the steel for a required analysis taking considerably less of the alloy. In a charge averaging about 0.50 per cent manganese only about 0.10 per cent addition will be required to overcome the loss. While the first metal test will show similar to the two slag process in manganese content. the slag will contain most of the manganese, which will be reduced back into the metal during the finishing period. Under such circumstances it is preferable to have a chemist make an analysis of the metal if regular analyses are to be had.

Carbon Picked Up

The melter always must bear in mind that his steel when up to a fair temperature, and under a strong carbide slag, always will pick up carbon. The amount so absorbed will depend greatly upon the volume and condition of the slag, the temperature of the slag and metal and the length of time so held. Every shop should determine their average gain in carbon, by making experiments, and then should allow for this when making additions. The general average will be from 0.030 to 0.060 per cent, assuming a slag of from 4 to 5 per cent of the charge by weight, and holding under a carbide atmosphere from 45 minutes to one hour. Experiments made on a 6-ton furnace making steel castings, and holding the metal under the white slag for 45 minutes, showed an average pickup of 0.060 per cent. However, in this case the metal was made rather hot which in-

creased the rate of absorption. Other metallurgists have reported a pick up as high as 0.130 per cent in 45 minutes.

Melting with partial oxidation seldom is used when making low carbon steels., especially those under 0.40 per cent carbon, but is widely applied for the hard or medium hard grades. The charges here are made in a different manner, being so proportioned that the heat will melt down within a few points either way of a predetermined analysis. For example, assume a heat requiring a finished analysis of from 0.45 to 0.50 per cent carbon, with a manganese of 0.60 per cent. The steel will pick up approximately 0.06 per cent carbon from the slag, 0.050 per cent from the ferromanganese, making a total of about 0.10 per cent carbon before slagging off. If the rate of oxidation for the particular class of scrap to be used is 10 points on the melt down, without a boil, the charge of scrap can be made of metal analyzing 0.45 to 0.55 per cent carbon. Therefore this metal when melted will contain approximately 0.35 to 0.45 per cent carbon.

If the metal is allowed to remain under its oxidizing slag the result will be

FIG. 24—ABOVE—TYPICAL FRACTURES OF CAST STEEL BASE PLATE WITH CARBON 0.30, MANGANESE, 0.65, SILICON, 0.31, SULPHUR, 0.031, PHOSPHORUS, 0.038 PER CENT—THE LOWER PLATE HAS BEEN WATER QUENCHED, WHILE THE TOP PLATE IS ANNEALED

that the remainder of the carbon will be eliminated, requiring a considerable amount of work and recarbonizing material to bring it back to specification. It is advisable to stop this oxidation, and immediately start upon the finishing period.

If desired, this first slag can be run off and a new one added. If this is practiced it will be necessary further to heat the metal to give the necessary temperature to the slag, to enable it to run from the furnace. During this heating the carbon will drop lower unless steps are taken to prevent such an occurence. The best method of doing this is to add a small amount of either ferromanganese or ferrosilicon, and then dust the slag lightly with powered coke. The force of the oxides are transferred from the carbon in the metal to these additions with the result that the steel analysis will remain constant which is an essential point.

If only one slag is used the carbon should be allowed to drop at least five points lower, and the metal heated. As soon as this point is reached add the ferroalloy, and give a fair dusting of coke, immediately followed by the final slag materials. The amount of first slag to use will depend upon what disposal is to be made of it. If to be slagged, the first slag may contain at least 2 per cent of lime. If only one slag is to be used, the first slag should contain only enough lime to combine with any dirt or impurities in the scrap, and still remain basic.

Using a White Slag

Melting under a white slag rarely is practiced in the foundry, although widely practiced making high-carbon tool steels. The only time such a process is used in making castings is in certain cases where high carbons such as 0.70 to 0.80 per cent are required for use in crushing machinery where an unusually hard steel is necessary. In charging the furnace for such a heat, a certain amount of coke is charged with the scrap. During the melt down, the slag is added, and a small amount of coke added from time to time to furnish the proper reducing atmosphere. The furnace must be sealed tightly at all times, as an influx of air will destroy the desired conditions. The coke added must be carefully checked as an excess will make the carbon too high. Under such an operation a carbide slag will be found on the metal, and if adjusted properly the steel will melt down to an analysis such that only slight additions will be necessary before pouring. Such practice requires a chemist on hand for the entire course of the heat, and for ordinary casting work does not give results commersurate with the increased care and cost.

Making Acid Steel

THE acid process of manufacture has become so important from a commercial viewpoint over the past five years that its procedure deserves the closest consideration. The common idea regarding the acid process is that its operations are so simple that a green man safely may operate a newly installed furnace. This naturally has resulted in many varying methods of operating an acid furnace, some good, others bad. It is the writer's opinion that as much experience is required to make first class acid steel as the basic metal. Whoever has been held to rigid specifications on this process will agree on this point.

At first glance, the acid process offers merely a means of melting, and superheating a mass of steel to the pouring point, and teeming into molds. The final steel in such a case is no better than its preliminary charge of scrap, and often, due to poor operating practices, it is far worse. That this is the purpose of the acid electric furnace is a fallacy. While it is perfectly true that there can be no phosphorus elimination under the conditions of an acid slag, it also is true that there can be slight decrease in the sulphur content, due to its burnings away under melting. The other components of the steel can be controlled closely, and

FIG. 25—BELOW—THE UPPER PLATE IS ANNEALED AND THE LOWER WATER QUENCHED, WHILE THE ANALYSIS IS CARBON, 0.26, MANGANESE, 0.59, SILICON, 0.29, SULPHUR, 0.027 AND PHOSPHORUS, 0.033 PER CENT

by proper slag manipulation, the bath of metal can be as well deoxidized as under the basic carbide slag.

The rapid increase of acid lined electric furnaces is the best argument as to their ability to make a satisfactory grade of metal. Acid practice is rapid and economical. The product is high enough in quality to satisfy the most discriminating. The percentage of lost castings is low. The process offers exceptional opportunities for making small, green-sand work, due to the high temperatures to which the metal may be heated. In short, for general steel casting work, the acid furnace offers as near perfect conditions as it is possible to attain. The personal element entering into its operation is the controlling factor.

Due to the insignificent reduction of any derogatory elements, the scrap used

must be sufficiently low in phosphorus and sulphur to allow the finished metal to fall within allowable limits. As the present maximum limit of both sulphur and phosphorus in acid steel castings is 0.060 per cent this is a point which is rather easily met, almost any grade of open hearth melting scrap being suitable. This scrap should be segregated exactly the same as that for the basic furnace. However, greater care should be used to avoid large amounts of rust on the metal. Iron oxide offers a much different action on the acid hearth than on the basic. Under the conditions of the basic magnesite hearth, which is not attacked by oxide, this rust throws its entire strength to oxidizing the carbon, manganese, silicon, and phosphorus. The acid furnace bottom will be corroded rapidly by this oxide which may cause serious trouble in several ways, either by hearth cutting, or by bringing down the metal in an over-oxidized condition.

The acid furnace is rapid and there should be no lost time, if steady production is sought. Therefore, it is bad practice to boil the metal, or to have to recarbonize. Consequently, the balancing of a scrap charge becomes important. A charge consisting largely of shop scrap or other large chunks always will melt down high, requiring much manipulation to prevent excessively high percentages of the elements. particularly silicon. The opposite charge, one of all light scrap, will result in an over oxidized condition, requiring constant work to bring back to a solid state. Naturally a charge of clean metal will come down higher than a furnace load of heavily rusted steel.

After running two or three heats on a new furnace it becomes easy to proportion the different classes of scrap so that the steel on the melt down always is approximately the same composition. In making up a charge several main points should be followed. These are:

Phosphorus and sulphur should be within limits.

The proportion of light to heavy metal should be about the same for each heat

The physical condition of each charge should be the same as regards the amount of clean, medium and dirty scrap.

The chemical composition of each charge in carbon, manganese, and silicon should be kept as closely the same as possible.

If these points could be observed in a mathematical manner, the acid furnace would turn out the same grade of steel heat after heat without any supervision. However, this is impossible and it is these minor changes in the scrap which necessitate expert supervision, if steel of a constant and regular composition is to be made with a minimum of expense, and loss from unnecessary operations.

In charging the furnace for making the ordinary grades of soft steel castings the writer has found that a charge consisting of about 25 to 30 per cent, heavy scrap, the remainder light shoveling steel, will give satisfactory melting conditions.

Table XXXI

Heat Log of Carbon Steel Made by Two Slag Basic Process

RAILROAD wrought scrap comprised the greater portion of the 13,000 pound charge. A total of 8000 pounds of railroad wrought was charged with 5000 pounds of punchings.

The large amount of phosphorus in the wrought iron brought the approximate phosphorus in the charge to 0.100, and as the allowable limit for the product was 0.060 per cent, the required amount to be lowered was slightly over 0.040, there being a slight pick up from the ferromanganese.

The desired specification was:

	Per cent
Carbon	0.24 to 0.32
Manganese	0.65 to 0.75
Silicon	0.24 to 0.32
Phos. and sulphur, under.	0.060

The metal was poured into steel castings for locomotive work, the castings requiring a large amount of finishing.

2:10 p. m.	Current on, and drawing as full a load as possible.
2:35	Electrodes digging rather deep. Raised and the holes filled with a small amount of the charge left out of the furnace for this purpose. Beneath this cold scrap was thrown approximately 200 pounds of burned lime.
3:20	Good pool formed in furnace, and a steady load obtained.
4:10	Metal practically all melted, loose pieces poked into bath. About 100 pounds more lime added. The bath is bubbling easily and quite steady. Test slag taken shows a good black in color, and with the desired lava like structure.
4:40	First metal test taken. Shows a dead melt. Carbon judged at 0.120 per cent. Slag of a good color, but slightly thin. 50 pounds additional lime added, and well rabbled into the slag. Given 10 pounds of lump ferrosilicon to quiet the metal.
4:50	Furnace tilted slightly and the slag worked toward the spout. Current off and slag pulled from furnace as quickly as possible.
5:00	Current again on. Ferromanganese figured at 0.50 per cent added. One-half of second slag added from both side doors. This slag made up of burned lime, 350 pounds; gravel spar, 75 pounds; and coke dust 30 pounds, being well mixed on the furnace platform. In 10 minutes the slag was given a good dusting of ground coke, and the remainder of this finishing slag added.
5:20	Slag test taken shows a darkish brown, turning to a lighter color in spots. Metal test taken and sent to chemist for manganese and carbon. Doors tightly sealed and furnace allowed to run under a steady load.
5:30	Slag test showing a darkish gray in color. About 25 pounds of finely ground fluorspar was dusted over the slag, with approximately 10 pounds of small sized ferrosilicon. Another dusting of coke and furnace again sealed. The reducing flames are now heavy and luminous. The bath in under perfect reducing conditions. Chemist reports manganese 0.48, carbon 0.19 per cent.
5:40	Slag showing signs of carbide; powdering in air with a light acetylene odor. Ferromanganese added at 0.10 per cent. Slag foaming slightly under the electrodes.
5:50	Slag a perfect carbide, powdering to a dark gray. Metal test taken still shows slightly wild. Silicon added at 0.05 per cent, with another light dusting of coke. Sample sent to laboratory for final analysis. Metal given a light rabbling and the doors again closed tightly.
6:05	Chemist reports carbon, 0.26 and manganese, 0.68 per cent. Final addition of ferrosilicon figured at 0.30 per cent added and the bath well rabbled.
6:15	Final metal test shows perfectly sound. Ladle called for and metal poured.

Slag after being poured from ladle was cooled in the pit with water and gave off the familiar acetylene odor. Slag analyzed 3.56 per cent calcium carbide.

Final metal analysis:

	Per cent
Carbon	0.28
Manganese	0.71
Silicon	0.30
Phosphorus	0.058
Sulphur	0.031

Total time for heat 4 hours, 10 minutes. Castings poured perfectly, the metal lying quiet in the molds, and finally shrinking deep in the gates and risers. The metal on machining was easy to cut, and reasonably tough, showing practically no flaws, outside of several small sand spots. A skim gate was used on the furnace, and the metal was poured from a bottom pour ladle, using a two inch nozzle.

Table XXXII

Heat Log of Carbon Steel Melt, One Slag Basic Process

THE charge which was made up of 7000 pounds of rail butts and 5500 *pounds of borings analyzed approximately carbon,* 0.45, *manganese,* 0.65 *and phosphorus and sulphur under* 0.045 *per cent.*

The specification called for carbon, 0.38 *to* 0.45 *per cent with manganese* 0.85 *to* 0.95, *phosphorus and sulphur less than* 0.050 *per cent, and silicon* 0.50 *to* 0.60 *per cent. The heat was intended for several large bull gears, these items taking the entire heat.*

12:45 a. m. Current on.
2:00 Furnace under steady load, after having to slip all three electrodes as they dug so low the arms touched the roof glands.
2:10 Added about 50 pounds of burned lime.
3:00 Added 25 pounds of crushed coke to stop the oxidizing action. Metal test taken showed close to 0.35 per cent carbon. Metal cold, slag thin and black. Allowed to heat up.
3:20 Tests showed the same conditions as before except the metal was hotter, and the slag had turned to a dark brown. Slag mixture totalling 250 pounds of lime and spar added. Dusted lightly with coke. Took a test for the chemist.
3:35 Test came back carbon 0.37 per cent, manganese 0.59. Added a light touch of coke and about 15 pounds of crushed ferrosilicon, and rabbled the slag well.
3:50 Slag assuming carbide conditions, but a little thin. Added 30 pounds of lime, rabbling in well, and 10 pounds of ferrosilicon. Metal getting hotter.
4:00 Slag perfect. Metal fracture appears to have picked up about 0.05 per cent carbon. Manganese figured at 0.30 per cent added, together with 0.10 per cent silicon.
4:10 Metal test solid. Slag perfect, and foaming heavily over entire furnace. Silicon figured at 0.50 per cent added.
4:30 Heat poured.

The final metal analyzed carbon, 0.44, *manganese,* 0.91, *silicon,* 0.57, *sulphur,* 0.039, *phosphorus,* 0.047 *per cent. The time of heat* 3 *hours,* 45 *minutes.*

This charge should analyze as close to 0.30 per cent carbon, and 0.50 per cent manganese as is possible with the scrap supply. If a large proportion of shop scrap is used, ore must be added to neutralize the added silicon, 25 pounds being about the correct amount to use in a 4 ton charge where not over 40 per cent is shop scrap, and where a final metal of under 0.26 per cent silicon is desired. If the scrap charge is rusty about 3 large scoops of old floor sand will give the necessary silica to satisfy this oxide without its attacking the hearth. This also will give the necessary slag body to prevent *watery* conditions, with attendant oxidizing and radiating conditions.

If a slightly higher carbon is desired it is permissable to charge either a small amount of pig iron, or some carbonaceous material such as coke, graphite or coal, so that the charge will be stopped on the melt down, and give a higher carbon when melted.

Melting Down the Charge

The charge being in, the current is turned on and the melting commences. The doors should be kept closed as much as possible during this period to conserve heat, and to keep air from the bath. The writer does not favor sealing the doors and making the furnace absolutely air tight as this will cause reducing conditions when they are not desired, with the result that the bath comes down to high, especially in silicon.

During the melt down period, the furnace will be subject to the same delays as on basic operation which will be handled in a similar manner. However, there is one condition, which should be watched, more carefully, that of *bridging* of the scrap. If this is bad on the basic hearth, it is fourfold worse in the acid furnace, due to the fact that a basic slag will conduct the current easily, while the acid slag is a poor carrier of electricity. Consequently if the hearth begins to dig, the arc instead of flaming to the slag, will be forced to dig under to reach the metal.

Table XXXIII

Heat Log of Carbon Steel Melt Under a White Slag

THE charge of 13,925 *pounds of low carbon scrap probably analyzed close to* 0.20 *per cent carbon,* 0.45 *per cent manganese, with both phosphorus and sulphur under* 0.040 *per cent. The major portion of the charge consisted of rather clean boiler plate and punchings. About* 200 *pounds of burned lime, and* 150 *pounds of pea sized coke were added between layers of the charge.*

The specifications called for the following:

	Per cent
Carbon	0.80 to 0.90
Manganese	0.50 to 0.60
Silicon under	0.15
Phos. and sulphur under	0.040

This metal was not for steel castings, but was to be poured into forging ingots from which track tools were to be made for railroad operations.

2:55 p. m. Current on.
4:00 Steady load after slipping electrodes, and filling up their holes with fresh scrap.
5:00 Good sized pool formed. Considerable scrap hanging to walls pushed into bath. Slag test shows carbide conditions in spots, but tending to a light brown in others caused by being contaminated with oxide from fresh scrap falling into the metal pool. Gave a light coke dusting.
6:00 All melted. Slag white, but rather thick. Added 50 pounds of gravel fluorspar, and took metal test for chemist. This test was fairly solid, but too high in carbon for a close reading.
6:20 Test came back 0.62 per cent carbon; manganese 0.42. Added ferromanganese figured at 0.15, and enough flake graphite to bring the carbon up 10 points. This was well rabbled in and the slag given another good coke dusting.
6:50 Perfect conditions. Slag a dark gray and powdering in air. Strong acetylene odor on a water quench. Metal faily sound. Final test taken for analysis. Doors sealed.
7:20 Test analyzed carbon 0.77 and manganese 0.54 per cent. Low phosphorus pig iron added to give five points of carbon. Silicon at 0.20 per cent added in lumps, being slightly moistened before thrown in, in order to splash the slag aside.
7:40 Metal test shows perfectly solid, with the seamed skin showing perfect deoxidation. Slag strongly carbide.
7:45 Heat poured. The metal poured like oil, setting in the molds without a spark.

The final analysis of the metal showed carbon 0.84, *manganese* 0.52, *silicon* 0.14, *phosphorus* 0.040 *and sulphur* 0.012 *per cent.*

This slag contained 5.34 *per cent calcium carbide. Total time of heat* 4 *hours* 50 *minutes. The total current consumption was* 5180 *kilowatt hours or* 740 *a ton.*

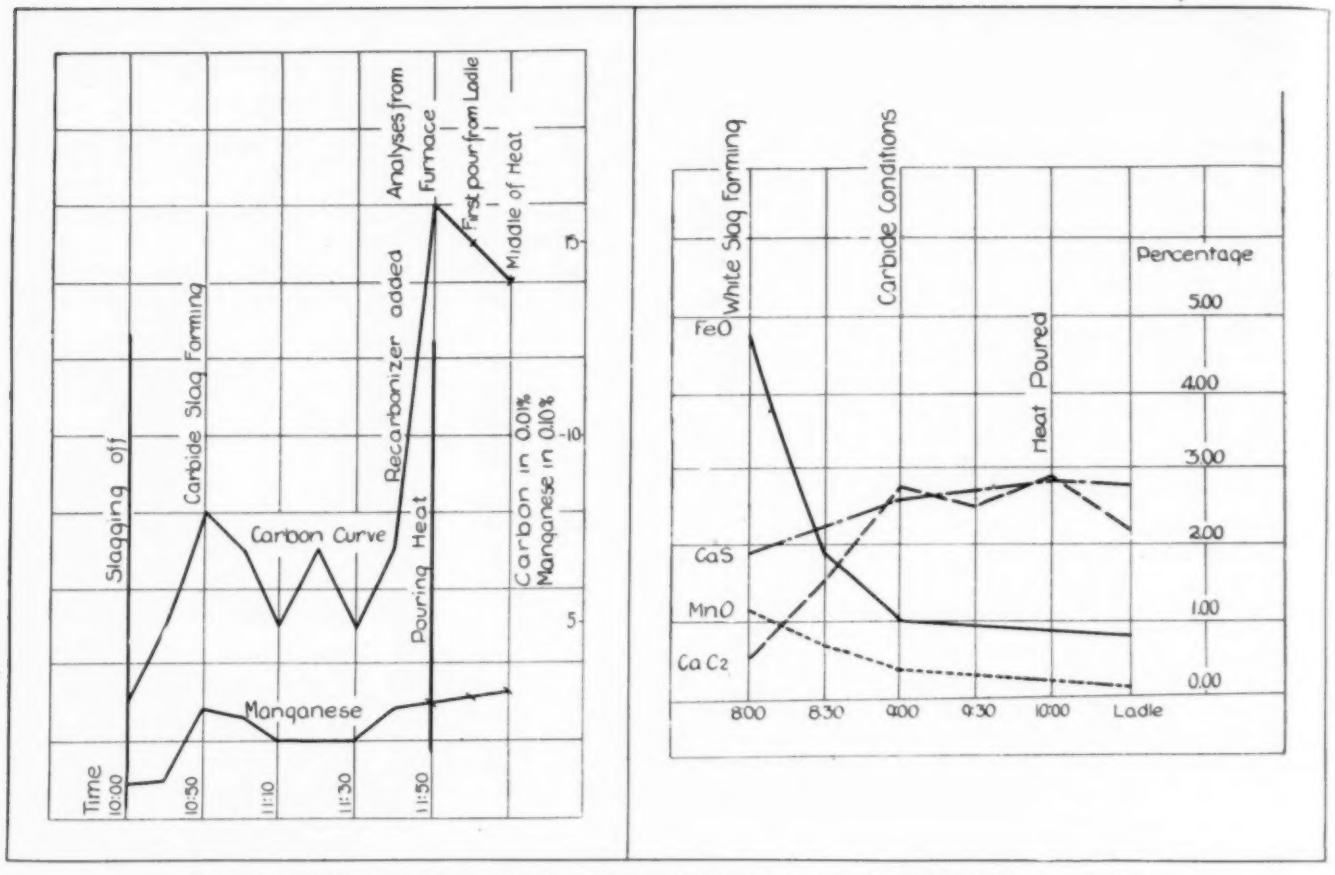


FIG. 26-27—VARIATIONS IN CARBON AND MANGANESE DURING PROGRESS OF HEAT

FIG. 26—The charge analyzed carbon, 0.20 to 0.25 and manganese 0.40 to 0.50 per cent, the scrap was rusty and the heat was run under dephosphorizing conditions without the addition of ore or scale—Ferromanganese was added after slagging off Fig. 27—Similar curve showing the drop of oxide constituents and the rise of those denoting deoxidation

Naturally, the result will be that as the small body of metal digs, the depth of the slag increases, becoming much worse each moment, until the arc will dig completely through the hearth. The best indication of proper melting conditions is the color and character of the flame arising around the electrode ports.

At the start of the heat, and for probably the first half hour this will manifest itself by a heavy reddish, brown smoke with little flame. As a pool forms, this brown smoke will change to a light yellow, accompanied by a reddish flame, which is rather sharp and irregular. As soon as the scrap begins to fall in from the walls, the red smoke recurs, but is not accompanied by heavy gusts of reddish flame, and often by dense puffs of heavy black smoke. As soon as the metal is all in the color again changes to that of the yellow fume, until reduction begins.

This is the appearance of a furnace melting down under satisfactory conditions. If *bridging* begins an entirely different appearance will be noted. About 30 minutes after the power is on, and when the electrodes are down rather deeply in the charge, the smoke will change to a dense white. This is the first sign of danger, but does not necessarily mean bridging. If this is soon accompanied by a soft, luminous flame, of a deep yellow color, it is an absolute indication of hearth cutting. Unless immediately overcome, this flame will continue accompanied by ever increasing amounts of white smoke, until soon *snowing* begins. This is caused by the carbon

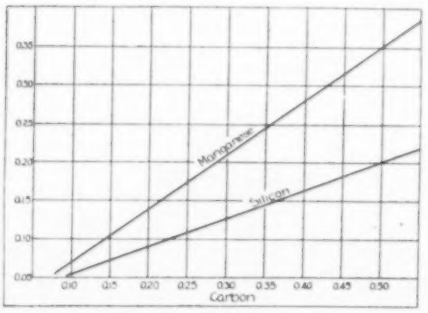


FIG. 28—VARIATION IN MANGANESE AND SILICON WITH ACID LINED FURNACE

of the electrode reducing the silica of the slag in the presence of the arc. The free silicon, in the form of a vapor rises, and as it leaves the furnace is precipitated by the cold air in the form of a heavy grayish powder resembling snow in texture. The writer has seen this come from a furnace in lumps as large as the fist, it having a soft, open feel to the hand, crushing to a fine grained powder when squeezed.

If *snowing* occurs, it is a sign of absolute danger, and if the bridging cannot be broken, the electrodes must be raised and as much molten slag pulled from the furnace as is possible, when fresh scrap can be added to the holes and the arc started on this higher metal. Often the charge is so badly bridged that its is impossible to reach the holes from the doors. In such a case, the electrodes must be raised and fresh scrap added through the ports in the roof, the scrap being added high enough so that contact will be made with the bridge portion. It is here allowable to add a small amount of ore, about 25 pounds being ample, to take care of thinning this heavy slag, and to start sufficient of a boil to tend to undermine the fused scrap and allow it to fall into the pool.

Under any condition as soon as a fair sized pool has formed the condition of the metal should be determined by slag and metal tests. A metal test will show the percentage of carbon either from fracture or analysis. Experience also has shown that a certain carbon content nearly always will be accompanied by the corresponding amounts of manganese and silicon, when melting scrap of a uniform type. This information gives certain data on the progress of the heat a high carbon meaning that the manganese and silicon are up, and a low carbon the

(*Concluded on Page* 951)

Grind Steel Track Castings

Railroad Frogs, Switches and Crossings Made from Manganese Steel Require Considerable Grinding—Parts Straightened by Hydraulic Press—Swing Frame and Portable Grinders Used

BY FRED B. JACOBS

DUE to its wearing qualities, manganese steel is used extensively in the manufacture of rail frogs, switches and crossings. Such equipment is of two kinds inserted and solid. In inserted equipment, parts subjected to greatest wear consist of cast manganese steel inserts, but in the solid variety the entire unit is a manganese steel casting, which is finished entirely by grinding. While the grinding of frogs and switches is not a precision operation, care must be exercised to conform to dimensions, more or less exacting. At the plant of the Indianapolis Switch & Frog Co., Springfield, O., the output consists entirely of solid manganese steel frogs, switches and crossings. Preliminary to grinding various parts are straightened in a horizontal hydraulic press made by the company. It is capable of exerting a pressure of 350 tons. For finishing the end sections of frogs and switches a small wheel is used to get into corners. This operation is shown in Fig. 1. The portable grinder was made by the company. It is operated by a 3-horsepower motor. The wheel is driven by a long spindle housed in tube which forms a handle. The wheel is artificial alumina, 8 inches in diameter, 1¼-inch face, 16 grit, 1½ grade. As Fig. 1 shows, the work is conveniently mounted on a truck. Fig. 2 illustrates the method of grinding off a high section on the bottom of a frog. The machine used is a swing frame grinder made by the company, equipped with an artificial aluminum wheel 14 inches in diameter, 1¼-inch face, 16 grit, C grade or 16 grit, 1½ grade. This grinder is driven by a motor which develops 3 horsepower at 1700 revolutions per minute. The motor and grinder spindles are located at right angles. The motor is mounted back of the supporting yoke thereby counterbalancing the grinder. Power from the motor is transmitted through a shaft operating in a tube. The grinding wheel spindle is driven by a pair of miter gears housed in a dust-proof case packed with grease. This grinder also is used for fitting up the ends of the frog or switch to accommodate the fish plate. This operation technically is termed fishing.

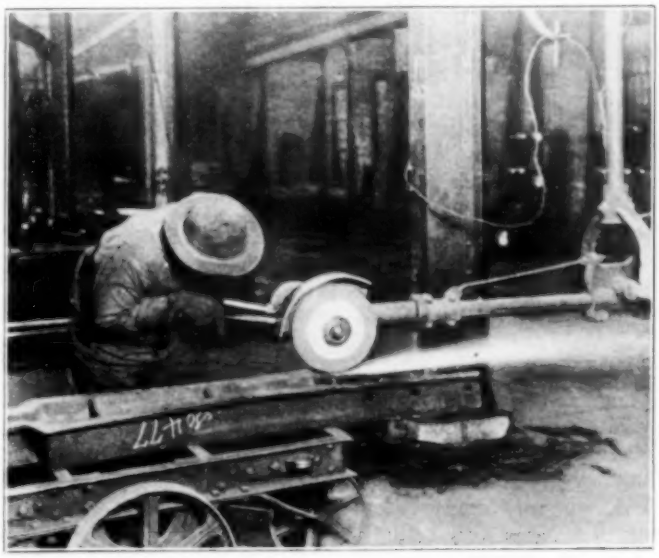


FIG. 2—FROG AND SWITCH BASES ARE GROUND UNDER ELECTRICALLY-DRIVEN SWING FRAME GRINDERS

In Fig. 3 a switch is shown mounted for surface grinding. This grinder is improvised from an openside planer built by Dietrick & Co., Baltimore. As the illustration shows, a grinding head is fitted to the cross rail saddle. The wheel is artificial alumina, 18 inches in diameter 3-inch face, 16 grit, G grade or 16 grit or 12-14-16 grit, 1¾ grade. The wheel is driven by a 15-horsepower motor, power being transmitted to the wheel spindle by a belt. The machine table is reciprocated at a speed of 20 feet per minute. It is operated by a worm drive, which is actuated by a 10-horsepower power motor. As the illustration shows, the work is strapped to the planer table. The wheel takes a cut approxi-

(*Concluded on Page* 951)

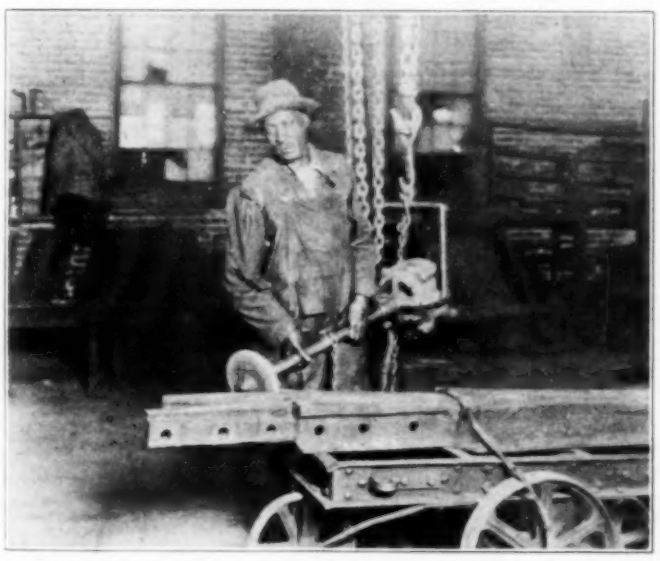


FIG. 1—PORTABLE GRINDERS ARE USED FOR FINISHING SECTIONS THAT CANNOT BE SURFACE GROUND

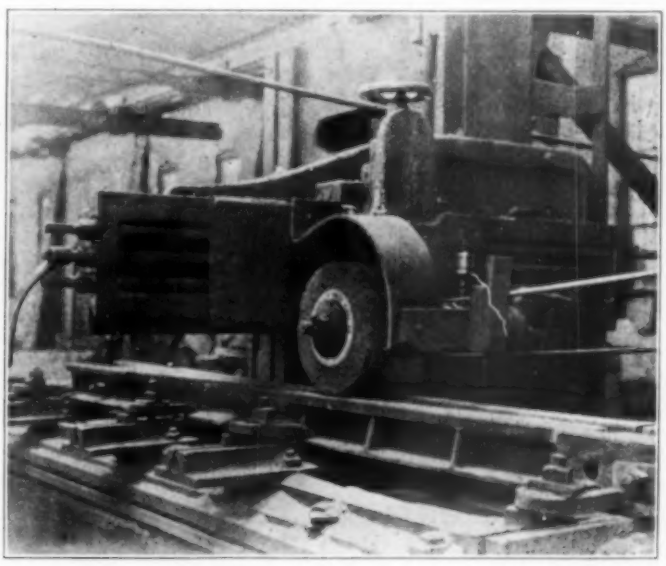
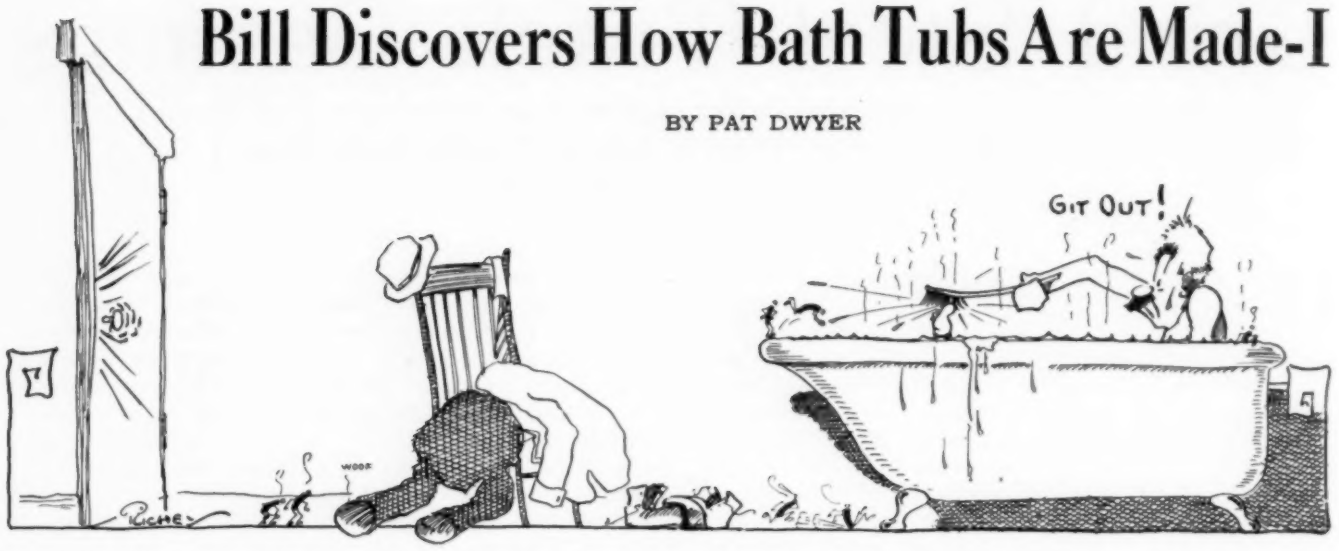


FIG. 3—A LARGE PLANER-TYPE GRINDER IS USED FOR SURFACING SWITCH AND FROG BASES

Bill Discovers How Bath Tubs Are Made-I

BY PAT DWYER



ONCE in a while—not to be too specific on such a delicate subject—I take a bath. I am not one of your modern heroes who boldly, nay blithely if you are silly enough to accept his own statement, jumps out of his warm little bed some time before dawn on every one of the 365 days throughout the year for the sole purpose of being able to say that he had a cold bath before breakfast. While the remainder of the family is sleeping peacefully he plunges into a vat of icy water, or stands shivering like an animated icicle under a shower of chilling needles until the spark of life is within one degree of being extinguished.

Naturally, I never actually have seen any person going through the entire process, but I have heard and read of people who indulge in the habit or should I say the ordeal? Indeed as you probably have observed in your own experience no system has been devised up to the present—at least no workable system—that will protect the innocent public from having the story of these weird and wonderful exploits inflicted on them. Instead of trying to conceal their shame or of using all legitimate means to prevent their friends from hearing of the pernicious practice to which they are addicted, these misguided soakers actually boast of their will. The only manner in which I can account for the mania which impels them to remark nonchalantly on every possible, and impossible, occasion that they simply could not think of starting the day without the preliminary cold bath, is that the icy shower or the sudden immersion in the chilly tub, numbs the mind to such an extent that the victims simply babble irresponsibly, after the fashion of men talking in their sleep. I have not investigated the subject thoroughly and it may be that further examination will disclose contributing factors.

The foregoing opinion merely represents a first impression and in the spirit of your true scientist I am willing to admit that it is subject to modification or revision if further disclosure or material evidence of any kind is submitted to warrant a movement in that direction. I am open to reasonable conviction at any and all times, but so long as these early morning, icy bathtub tales only excite my sympathy instead of the admiration so pathetically and evidently expected by the martyrs who tell them, I shall keep my own counsel and most decidedly I shall not try any personal experiments.

When I take a bath, which as I said before happens once in a while, I trust you will not gather the general impression that this is an annual rite or even restricted to synchronize with the appearance of the full moon each month, I fill the tub about half or possibly three parts full of water as near the boiling point as I can stand, short of actually scalding the well known epidermis or outer covering off the body. I was tempted to use the word hide, but the art of bathing as practiced almost universally in modern homes is a sacred and intimate process and therefore such a vulgar word as hide automatically is ruled out of the description. Besides, in a more or less intangible manner it suggests the use of a scraper and in all modesty I submit that up to the present I never have failed to achieve a reasonable measure of success without the use of any instrument or abrasive except the usual soap and water.

Following the example of experienced bathers, amateurs in good standing, professional bathers and others who are acknowledged as standard authorities on the subject, I invariably remove every vestige of clothing before entering the tub. This may seem an extreme measure and in some quarters undoubtedly will be regarded as a slavish following of custom, but I have followed the practice for many years and unhesitatingly recommend it to any person who through lack of early education, a mistaken sense of propriety, or failure to keep up with the procession still clings to the antiquated habit of wearing a bathing suit.

Quite true literature on this point is not as prevalent as it is on many less important subjects. Pictures on the screen invariably are cut at the point where the hero enters his palatial bathroom. This deprives an eager public from its legitimate right to see how he sizes up in the altogether or, to use the proper technical phrase, on the hoof. Still the fact that he appears in the next scene clothed in an immaculate new suit might lead one to the reasonable inference that he had shed his inner as well as his outer garments. I am willing to admit that the element of doubt enters here, but still the inference regarding the complete change is at least fairly

AFTER THE BATH

reasonable. However, my own personal experience backed by the written and spoken opinion of many men in public and private life is that clothing of any kind is a liability rather than an asset if one expects to derive the full benefit of a bath.

The other night I emerged from the bath tub, 99.99 per cent pure and donned the clean linen and all that kind of thing which fortunately I had discovered before I shed the other. Two of my immediate relatives have arrived at a stature recently which qualifies them physically, though I should not like to say morally, to wear my size of clothes. In one respect I suppose there is cause for congratulation, but the condition unfortunately also has its disconcerting features. Through some peculiar twist in their mental machinery they cannot distinguish between mine and thine and the net result is that if they cannot immediately lay their marauding paws on one of their own suits of underclothes they entertain no scruples apparently in annexing one of mine.

Sometimes, through absent mindedness, I neglect the proper precaution of examining the linen closet before I disrobe and when I creep out of the tub later I am greatly embarrassed to find nothing on the shelves or in the drawers excepting a supply of household linen and a quantity of garments which while excellent in themselves are not available since they clearly have not been designed for my use.

However, in this particular instance I found a suit that fitted. I wasted no time examining it for possible marks of indentification, but instead I silently thanked providence for its many mercies, tempering the wind to the shorn lamb and all that jolly old pastoral allusion, you know. I wasted none of the precious time and tide that wait for no man, but hastily, deftly and I trust in a thoroughly workmanlike manner slipped my parboiled frame within the grateful folds of the garment. I reflected, philosophically, that in this gross materialistic and modern age the benediction, every man for himself, is peculiarly applicable.

Arrayed in just a sufficient number of garments to get by the censor and with the virtuous and contented feeling of a man who has performed his duty, his painful duty, well and faithfully, I descended the stairs and parked my pure —I hope the printer won't make that poor—little person in an easy chair. I felt that really I had done enough for one night, that I could knock off, call it a day, ring out, and that I rightfully was entitled to a few hours' peace with a pipe and a book, any book.

I anticipated no interruption beyond the usual 1001 questions incidental to the preparation of their home work by an assorted band of young relatives. Through experience gained over a period of many years I have come to look upon this as a minor ordeal of really insignificant importance.

CONVERSATIONAL PLANE FALLS INTO AN AIR POCKET

At one time I envied these gifted vaudeville lads who play a different tune on a piano with each hand and at the same time gaily carol a little ditty having no relation whatsoever, ladies and gentlemen, to what they are playing. I have lost all sense of reverence for these artists. Nothing to it dear friends. Nothing at all.

Before the usual seance fairly was under way, Bill came trickling in and I reluctantly laid the book aside. Noting my *dishabille* he inquired solicitously if I was coming or going. I told him I was no mind reader, but if he kindly would be a little more explicit and not so parsimonious with his words, I gladly would furnish particulars.

Bill rose to the occasion in his usual able manner. He intimated that my scanty attire had led him to wonder whether I was coming from bed or going to the same well known retreat.

"Heaven knows," said he, "this is no time for a healthy man to be getting out of bed and certainly you have no cause to be weary except the weariness may be induced from toting that shape of yours around all day."

I countered, a trifle tartly, that he was wrong on both counts and that as a guesser he could qualify without trouble as a member in perpetual good standing of that august and useless body which counts our straw votes. I explained that I just had a bath and I could see neither the expediency nor the necessity of dressing up like a pig at a fair in view of the fact that I fully intended to go to bed in a short time after he had decided to go.

"Well," said Bill, "I guess an occasional bath will not do you any harm. I don't believe I ever told you of a peculiar experience I had one time in attempting to gather information on the subject of how bathtubs are made in this land of the free and home of the brave where a bathtub has come to be regarded as about as necessary a piece of household equipment as a stove or a phonograph. At one time or another I have worked in foundries devoted to the production of practically all classes of castings, but up to the time I have in mind I never had tried my hand on bathtubs. I lost no sleep or weight worrying over this point and probably never would have taken a look into a bathtub shop if I had not been asked one day to describe how the castings are made. I had to confess my ignorance and that confession incited my curiosity to a point where I determined to secure some first hand information on the subject.

"The nearest bathtub foundry was located in a town at a considerable distance from where I lived, but it was controlled by a large and powerful company and maintained offices and show rooms in practically all the principal cities, including the city which at that time I favored with my presence. I determined to visit one of these show rooms and felt quite confident that the man who sold the goods would be able to explain the manner in which they were made. Could he? My dear I cannot tell a lie. He could not.

"When I entered the imposing front office I was confronted by a confident and breezy young future financial giant. I told him frankly I had no intention of buying anything. All I wanted was information. He assured me expansively that all I had to do was to say the word. 'Shoot,' says he.

"Without any pretence or equivocation I explained exactly the predicament in which I found myself and asked him if he could explain briefly the process employed in making the type of bathtub in which a white wall or apron extends to the floor. Some tubs present this wall on one or both ends in addition to the side and in a few instances it may be seen extending on both sides and both ends of the tub. The purpose of course is to conceal the floor area under the tub, also to conceal the somewhat rough outer surface of the tub itself. During the finishing process the outer face of the apron is enameled to correspond with the inner, or what you might call, the working side of the tub. This type of tub sits closer to the floor and to

the wall and presents a more pleasing appearance than the ordinary type with the rolled rim and the four little short legs.

"The young man laughed good naturedly and assured me the process really was quite simple. They were made in sand molds in one of the compay's plants, then enameled and shipped in car load lots to the various cities. I pointed out to him—I trust with proper humility—that I was not interested in the consideration of tubs in wholesale lots. What I really wanted to know was the style of flask in which the tub was made, also how was the hanging pocket of sand secured so that it remained in place after the pattern was drawn and while the mold was filling with iron.

"My young friend dismissed these points airily with the statement that they were of no importance. They were taken care of in the foundry by a gang of Hunkies or Dagoes or something like that. Making the tubs simply was child's play, but selling them—Oh boy—now there was a real job. Would I believe that during the past six months he had sold so many hundred tubs and he anticipated doubling that record in the second half of the year. I thanked him for the lucid and comprehensive explanation and then suggested that perhaps some other man in the office might have an item or two, minor items of course, which would help to round out my general knowledge on the subject. The chief admitted that was a happy thought. In accordance with the policy of the company several of the salesmen recently had been taken for a visit to the home office and manufacturing plant with the laudable view of familiarizing them with the product and with the spirit of the company for whom they worked. Fortunately one of these men was in the office at the moment and he would be glad to turn me over to him.

"This sterling young man started off on the same line as his predecessor, but by this time I had reached the saturation point and I begged him firmly to desist. If he knew anything of the foundry rigging or methods I should be delighted to hear it, otherwise I did not intend to trespass further on his time. He was a nice, friendly young fellow and acted in an almost human manner after I had cut the gas pipe and brought him down to earth. He admitted in justification of his limited information that he had been taken hurriedly through the factory in company with other members of a group of salesmen and as a result his impressions of what he had seen were more or less mixed.

" 'I daresay the idea was all right,' he said, 'but how do you suppose a man can pay attention to what a guide is saying when his entire attention is required to avert a sudden and violent death from big iron crates tumbling over and swinging from cranes. These things are swinging in all directions and if you try to avoid one you are sure to bump into a big pot of boiling iron on its way to pour some of the molds. The ground was covered with piles of sand, with molds in different stages of completion and with empty iron crates. The air was filled with dust and steam and pots of iron rushing in all directions and believe me fellah I was more interested in finding a way to escape than I was in observing how the tubs were made. As well as I can remember they packed the model in a big iron crate filled with clay or something, then they pulled the model out and filled the place with iron.'

"Upon my further inquiry as to how the sand was held in place or whether the casting was molded right or wrong side up, he admitted he had not the faintest idea. He had a general impression that the men pounded the clay into the crates with some kind of mallets, but he was not sure whether the mallets were made of wood or iron. I faded out of the place no wiser than when I entered.

"Finally I wrote to the headquarters of the company and explained I was a pilgrim seeking the light. I was consumed with curiosity to know how apron tubs were made and I would appreciate some information. To lighten the burden I admitted I was a molder and therefore the barest outline would be sufficient. I received a reply, brief and to the point.

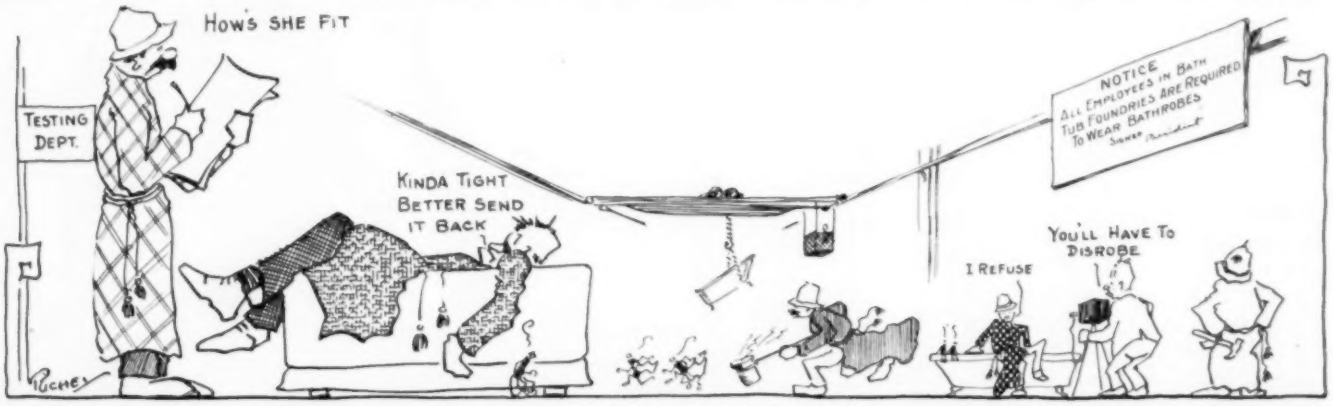
"In reply to your inquiry of recent date, beg to advise that bath tubs are made the same as any other casting. Say, wouldn't that put a crimp in your uncle's pet dog?"

"Well," I said, "Did you ever find out how they are made?"

"Sure I found out," said Bill. "Not long after the events hereinbefore stated, as they say in our best sellers, I blew into a town where among other features of interest I found a bathtub foundry in full operation. I applied for a job and worked there until my curiosity was satisfied. I'll tell you about it some time. However the incident serves as another illustration of the old maxim that the only way to get anything is to go and get it. It also bears out the statement that we get little for nothing.

"Do you remember the story of the old farmer who objected to the practice of his hired man in taking a lantern on his courting expeditions? 'When I went courting,' said he, 'I never took a lantern.' 'I'll say you didn't,' says the lad, 'and look at what you got!' "

The United States Silica Co., Chicago, recently has published a 56-page booklet entitled "Sand Blasting," giving a general discussion of abrasives and their most efficient use. The first chapter in the booklet is devoted to the report on a series of tests of various sand-blast abrasives at different pressures upon various metallic surfaces. The tests were conducted by the Stoney Foundry Engineering & Equipment Co., Cleveland, in machines made by the W. W. Sly Mfg. Co., Cleveland. Chapter two contains a discussion of the general principles and applications of sand blasting practice, while "What Happens in the Sand Blast," is described in chapter three. After a discussion of sand blast work, the remainder of the booklet is devoted to testimony from up-to-date shops.


HOW'S SHE FIT
TESTING DEPT.
KINDA TIGHT BETTER SEND IT BACK
NOTICE ALL EMPLOYEES IN BATH TUB FOUNDRIES ARE REQUIRED TO WEAR BATHROBES
I REFUSE
YOU'LL HAVE TO DISROBE
RICHEY

METHODS OF INSPECTION DIFFER TO SOME EXTENT FROM THOSE PRACTICED IN ORDINARY GRAY IRON FOUNDRIES

Lauds Pearlitic Cast Iron

European Writer Ascribes Desirable Properties to Iron Cast Under Close Control as To Analysis and Cooling Rate—Structural Differences Noted

BY C. IRRESBERGER

IN A former article, Dec. 15, 1923, THE FOUNDRY has given an account of the nature of pearlitic cast iron. In the meantime many errors concerning this kind of casting have spread in consequence the following supplementary discussion may be of interest.

It is not true that a low silicon content and slow cooling are essential for the formation of the pearlitic structure. Low silicon content and slow cooling favor such a condition, but are by no means positive. The time of cooling must be adapted to the silicon and carbon content which is of major importance owing to the wide variation in the percentages of these two elements and the difference in the speed of cooling or set of the metal. The speed of cooling may be adapted to a standard mixture or the mixture may be proportioned for a certain speed of cooling.

The required speed of cooling is not affected by the thickness of the casting. As the cooling is not the same in large pieces and in thin ones, certain precautions must be taken to attain equal speed of cooling in pieces of different thickness. To retard the cooling of the molten metal, the mold may be heated before the pouring, it may be kept heated longer after pouring the casting by external conduction of heat, or the speed of cooling may be slackened by casting the iron at a higher degree of heat. Another measure to influence the cooling lies in the choice of the material for the mold in the arrangement. In permanent molds heated to a high temperature, the cooling period will differ considerably from the speed of set if the metal is poured in a green sand mold. If liquid iron is poured into the hollow core of a cylindrical mold immediately before the real casting, its speed of cooling will be greatly retarded. There are a great many similar means to hasten or retard the speed of cooling of the metal.

A less reliable means of obtaining pearlitic cast iron is to anneal the castings. It is necessary to shake out the castings immediately after setting and to place them in the heating furnace while still bright red. A harder skin is formed which is not easily removed and which is detrimental to the formation of pearlitic in the casting. A principal advantage of a true pearlitic casting is, that its structure is uniform throughout.

Heating the molds, is a simple matter. The molds are placed in an oven which is heated to a certain degree of temperature and are taken out of the furnace immediately before casting. Experience will teach the time which the mold must be out of the oven to acquire the correct temperature. In the beginning it is best to place a thermocouple in each mold before casting to measure the temperature. However, after a little practice, this will not be necessary. After pouring, the castings are left in the mold till they are sufficiently cooled to be taken to the cleaning room.

In consequence of the numerous pos-

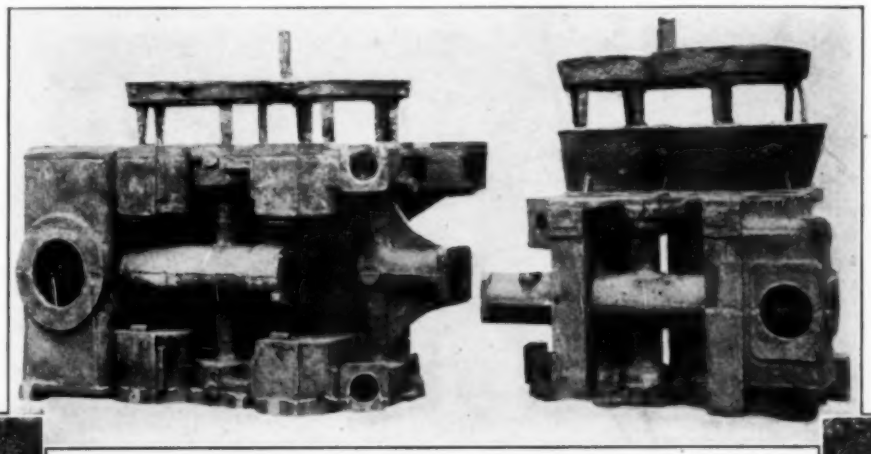


Fig. 1—Compound Engine Cylinder Cast From Pearlitic Cast Iron

Fig. 2—Cylinder Cast From Gray Iron With a Heavy Riser or Head

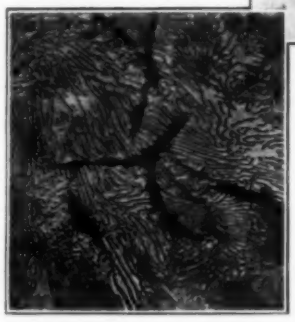


Fig. 3—Left—Pearlitic Structure of Iron from Fig. 1

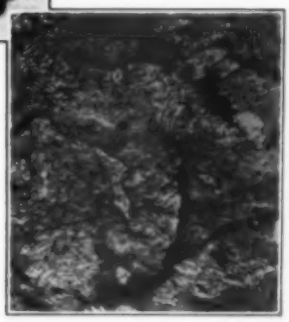


Fig. 4—Right—Structure of Ordinary Iron from Fig. 2

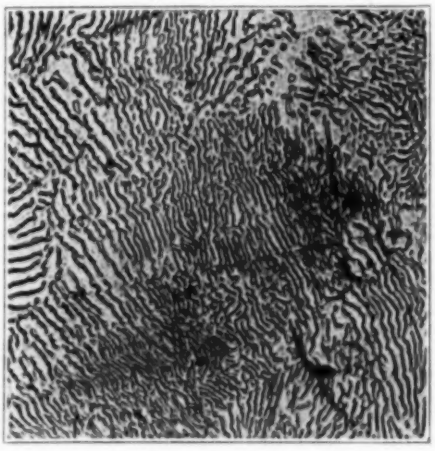


FIG. 5—SHORT FIBROUS PEARLITIC STRUCTURE IS PRODUCED BY QUICK COOLING

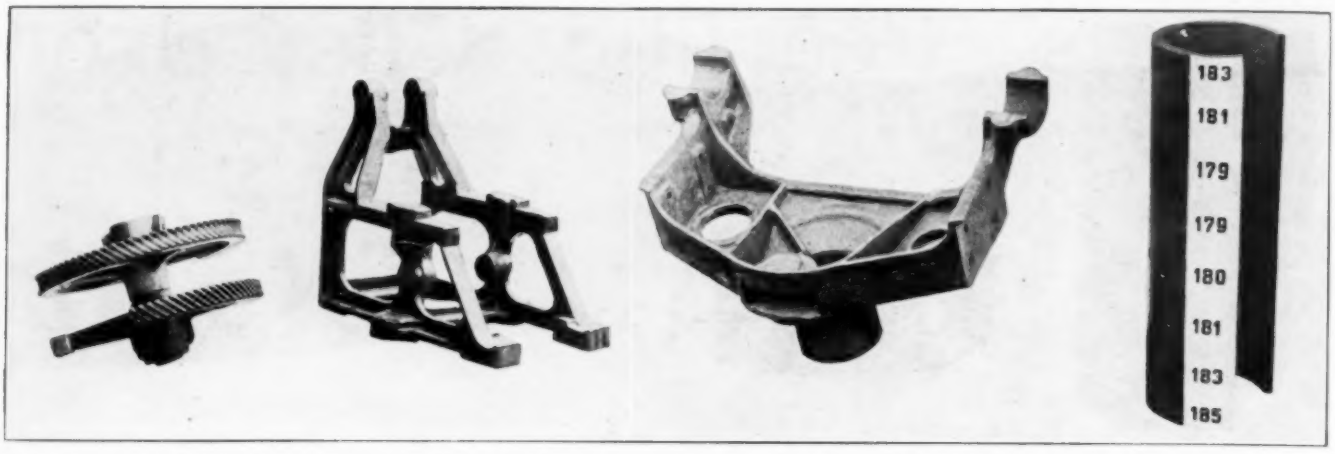


FIG. 6—THE UPPER GEAR OR ORDINARY IRON IS CONTRASTED WITH THE LOWER ONE OF PEARLITIC IRON FIG. 7—REGULATOR BLOCK MADE OF PEARLITIC IRON FIG. 8—END BRACKET FOR TRACTOR FORMERLY MADE OF STEEL FIG. 9—PEARLITIC CYLINDER

sibilities for influencing the speed of cooling, it is evident that it is possible to produce pearlitic castings of different thickness of wall from the same iron mixture, and from the same ladle. It is always preferable to retard the speed of cooling, because the formation of a hard skin is prevented, the piping and stresses are reduced and the ultimate tensile strength and ductility are improved by more gradual development of the structure.

The variations of high or low sulphur content of the metal has no effect on the formation of pearlitic iron. The best results are obtained with mixtures where the carbon and silicon content is so conditioned that the castings set in correct time without any special precautions being taken. Malleable mixtures, if correctly handled, produce good pearlitic castings.

Automotive Mixtures

For automotive cylinder blocks, a low silicon content, about 1 per cent, is of advantage because castings with a higher silicon content alter their structure at higher temperatures, whereas the 1 per cent silicon irons keep their structure even at a high temperature.

The assertion often has been made that the iron for pearlitic castings can be melted only in crucibles. Such an assertion is misleading. Only the mixture and its proportion combined with the speed of cooling are important, whether it is melted in a cupola, hearth furnace, reverbatory furnace, or in any other furnace fit for melting iron. The cupola furnace generally is used for such a purpose.

Pearlitic castings show an exclusive pearlitic structure. The casting throughout shows a *lamellare*, foliated, pearlitic structure, *ferrite* and *cementite* structures are wholly avoided. The owners of patents covering pearlitic casting do not claim to have discovered the pearlitic structure and its more or less perfect production in pearlitic iron. The endectic pearlite has been known for a long time and has been produced from receipts of old foundrymen on both sides of the ocean with tolerable security. However, these men only succeeded in producing single pearlitic spots. It is to the credit of the two foundrymen, A. Viesenthaler and K. Lipp who by research have reorganized and defined correctly the best methods to use in producing satisfactory peariltic castings aided by the metallographical instruments and chemical analysis, and that the latter is only one of a number of means used to obtain reliable scientific data.

The advantages of pearlitic castings over common castings will best be discernible from the following examples, indiscriminately taken from practice: Fig. 1 represents a 300-horsepower, pearlite,

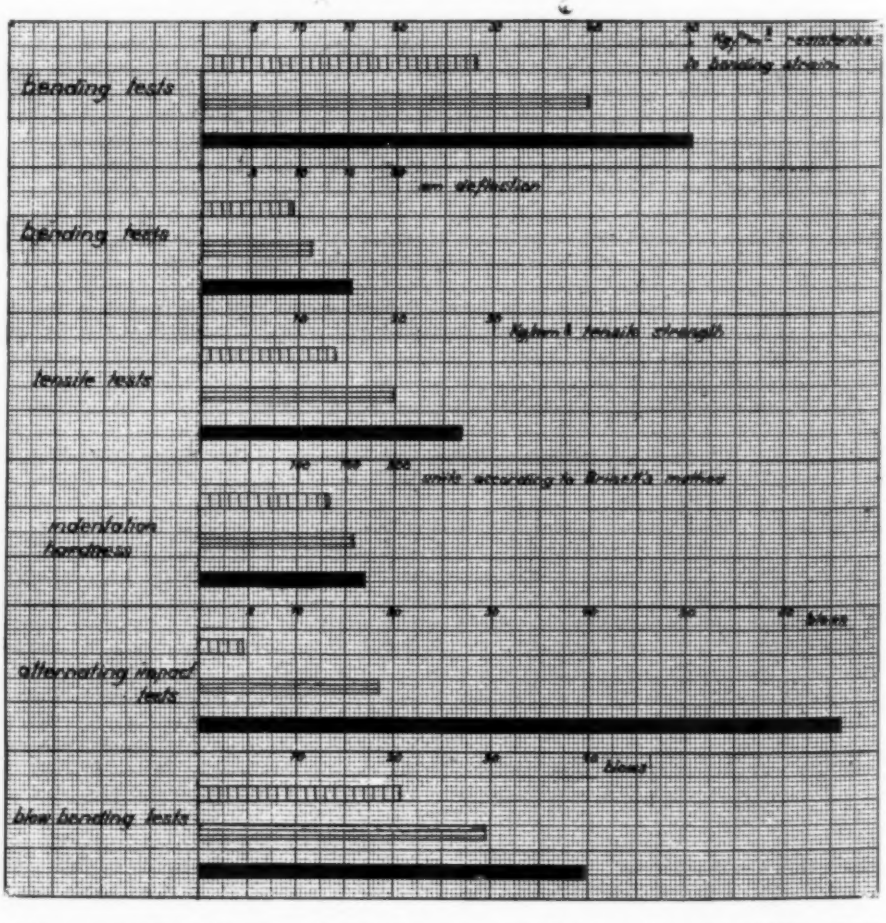


FIG. 10—COMPARATIVE PROPERTIES OF ORDINARY AND CYLINDER IRON AND PEARLITIC CAST IRON. THE COMMON IRON IS PERPENDICULARLY HATCHED, THE CYLINDER IRON HORIZONTALLY LINED AND THE PEARLITIC MATERIAL IS SOLID BLACK

compound cylinder with valve chest, cast without pouring head, and Fig. 2 another one of 200-horsepower which had to be cast with a pouring head. Fig. 3 displays the pearlitic structure of the 300 horsepower cylinder. It is evident how much cheaper is a cylinder cast without a heavy pouring head, quite apart from the greater security against spoiled castings in consequence of pipings and porosities of the iron composed and cast in the common way. Fig. 4 shows the structure of the 200-horsepower cylinder.

If the iron is cooled too quickly a short fibrous pearlite similar to Fig. 5 results. Such pearlite is by far superior to common iron, though it has not the full strength of the long fibrous structure.

Figs. 6 and 7 show two castings which, owing to the heavy duty work required formerly were produced as malleable castings. Fig. 7 is a regulating block for a railway signal work and Fig. 6 shows two gear wheels. The upper one made of regular cast iron was totally worn away after 30 hours' running, and the lower one, made of pearlitic iron, was still in serviceable condition after 400 hours' use. The transverse piece for a tractor, Fig. 8, formerly had to be produced as steel casting while it is now only made as pearlite casting.

The piston cylinder, Fig. 9, is marked to denote the different Brinell hardness measurements, which do not deviate considerably from the average value.

Test tabula, Fig. 10, shows the different values in strength of common cast iron, perpendicularly hatched, common cylinder iron, horizontally hatched, and of average pearlitic iron, drawn black. From this the extraordinary superiority of pearlitic cast iron is perceivable, especially striking at the alternating impact test.

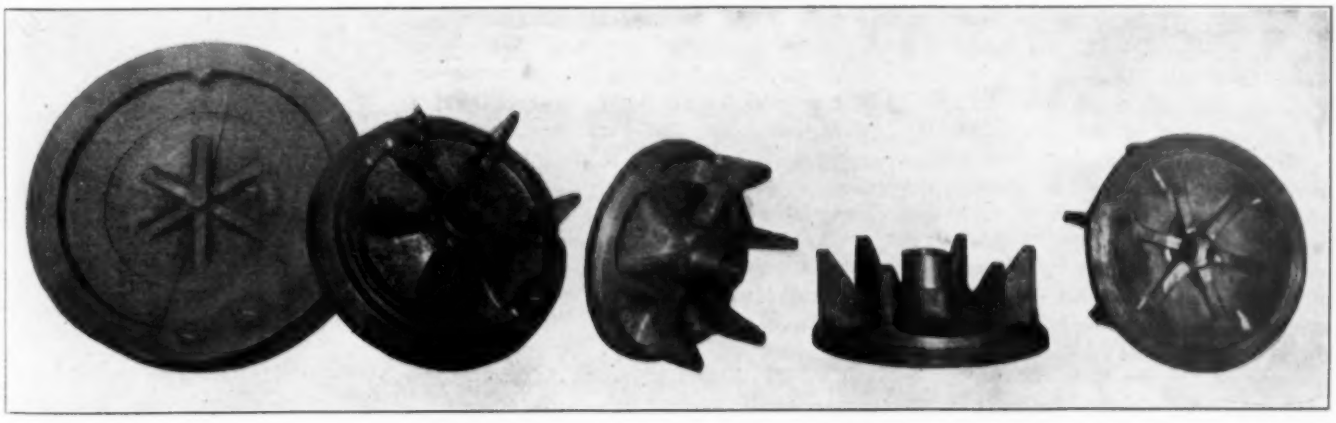
New England Shops Test Pet Theories

FRIENDLY competition between five New England foundries to produce a perfect casting afforded the greatest drawing card that the New England Foundrymen's association has had in years. Wednesday night, Nov. 13, the large dining room at the Exchange club, Boston, was crowded and interest centered at the head table where five locomotive valve castings with their patterns prominently were displayed. Gray-haired, old time foundrymen who had not been seen at the meetings for years turned out in force to hear of the difficulties encountered by their fellow members in producing the test castings. One old gentleman with some 40 or 50 years of foundry practice to his credit said he was tired of hearing these theoretical fellows talk about what might be done, but he said he was mighty interested in what some local foundry had been able to do in actual practice. This apparently expressed the opinion of many others at the meeting, and certainly the large crowd demonstrated that interest is keen in educational programs of a strictly practical nature.

R. F. Harrington, Hunt Spiller Mfg. Corp., Boston, gave a brief outline of the contest. A pattern of a rather complicated casting entering into the construction of a locomotive throttle valve was sent to each of the following five foundries: Blake & Knowles Steam Pump Works, Cambridge, Mass.; Barbour Stockwell Co., Cambridge, Mass.; Broadway Iron Foundry, Boston; Delano Iron Foundry, Everett, Mass., and Athol Machine & Foundry Co., Athol, Mass. The instructions were to make a casting soft enough to machine readily, free from impurities or blow holes, and of a structure to withstand 500 pounds of superheated steam. Under normal production practice it was stated that it was not unusual to get from 50 to 60 per cent losses in manufacturing this particular piece. Particular attention was called to the fact that the bore and valve seat must be absolutely free from shrinkage cracks.

The castings were made up and shipped in the rough to Hunt Spiller Mfg. Corp. where they were machined. They were then inspected by a committee of judges and marked either good or bad. The result of the judges' inspection was not disclosed, however, until after each representative of the foundry in question stood up at the meeting to start the description of his individual foundry practice. Pat Jordan, Athol Machine & Foundry Co., took charge of the meeting as soon as the general conditions of the contest had been explained, and he left no doubt in the minds of those listening as to his opinions of the different castings or molding methods.

The first man called upon was Sam M. Thompson, foundry foreman of Barbour Stockwell Co. As soon as Mr. Thompson stood up, Mr. Jordan turned to him and said "Your casting is no good." This was certainly an emphatic challenge and immediately drew the undivided attention of all the members. Mr. Thompson picked up his casting and was shown a small shrinkage crack in the bore. Otherwise the casting was perfect, being easily machined and of fine even grain. Mr. Thompson said the casting was put through the jobbing foundry in the regular way just as if it had come in the course of business. He said after looking the casting over and



THE CASTINGS CHOSEN FOR COMPARISON MIGHT BE TERMED TRICKY—SUCCESS DEPENDED ALIKE UPON MOLDING PRACTICE AND CHARACTER OF METAL USED

describing how he made it, that he would proceed the same way next time except that he would spread the gates further away from the hub. Furthermore he said that the metal used as determined by test bar taken at the time was not up to their usual analysis, and that he attributed part of the trouble to this fact. He said silicon ran close to 2.75 and that their practice was to keep it down to 2.50.

The next man called on was Peter Carney of the Broadway Iron Foundry. When Mr. Carney stood up he was informed that his casting was good, whereupon he smiled and then proceeded to tell how he made it. He said he used a largt horn sprue with plenty of pressure and that he also used ample chills between each of the fins. The metal used was the same as habitually used in the foundry, containing approximately 2.50 silicon.

The next man called was Mr. J. A. Leanard of the Delano Iron Foundry. He was informed that his casting was no good. After careful inspection of the casting which contained a tiny blow hole in the bore, Mr. Delano said that in making it again he would add about 20 per cent steel. He said the casting as made had too close a grain and that the silicon was too low. He said the work was put through the plant rapidly and without giving it any unusual attention. He was confident he could make the casting absolutely sound on a production basis by the same method used except that he would change the metal as described.

Herman Honold of the Blake & Knowles Steam Pump Works was called on next. He was informed that his casting was no good, and after being shown a minute shrinkage crack opposite one of the casting fins he said that his silicon was too high. He said that test bar showed the silicon to be 2.50 whereas had he been able to get the iron that he wanted he would have had it not over 2.20. The metal used contained 20 per cent steel, sulphur was 0.11, manganese 0.50, carbon 3.05 per cent. He poured the casting with the flange side down, used two sprues with a head of 6 inches of sand above the casting.

The chairman of the discussion, Mr. Jordan, then took the floor, and with a broad smile said that his casting was good. He said he made it with two opposing sprues and used 8 inches of sand above the casting. He said the metal used was not what he desired at all, but was all that he had available at the time. It was fully 2.60 silicon. Because of this he took no chances on having a poor casting. He put a vibrator on the flask and started vibrating the minute he started pouring. In addition to this he put an ounce of lead in the ladle containing 90 pounds of metal. He said besides taking these two precautions he thought of using chills, but finally decided not to do so.

In the discussion which followed all foundrymen agreed that the casting could be made up on a commercial basis with any usual good iron. Most foundrymen were inclined to the opinion that for commercial production the piece would have to be poured with the flange upward. Several stated that the use of chills was commercially feasible. Mr. Jordan said that if he were going to make it on a production basis he would use iron with silicon not over 1.90 per cent.

Binders for Steel Sand

Question: In our capacity as miners and shippers of silica sand we receive inquiries at times in regard to the best kind of binder to employ with sand of various degrees of fineness. We are familiar with our sand, its physical characteristics and chemical composition and we are prepared to supply it to meet definite specifications, but we confess we are not familiar with its manipulation in the foundry and will appreciate your opinion on the subject of binders.

Answer: There is no such thing as one *best* binder to use with silica sand for steel molding purposes. An extensive list of binding agents both liquid and dry is available and any one of the list will produce satisfactory results provided it is used in the proper manner. Manufacturers of core binders whose names and addresses may be found in the advertising pages of THE FOUNDRY maintain a staff of experts whose duty it is to demonstrate the product under actual working conditions. Among half a dozen steel foundries selected at random in any given area a survey will disclose in all probability that each one is using a different binder and a different sand mixture from the others. Through a series of more or less spasmodic experiments each foundryman has determined upon a suitable mixture and once having settled upon that he is not in favor of changing to any other. We suggest you secure copies of the literature sent out by the various core binder manufacturers, familiarize yourself with the contents and then either take up future inquiries direct or refer them to one or more of these manufacturers.

Testing Foundry Molasses

By George A. Drysdale

Question: Our attention has been called to testing molasses for foundry use, and we would appreciate any information you may be able to give us as to methods used in testing and interpretation of results. If there is any specification cut for this class of material, we would like to know of it.

Answer: We are unable to give you any definite specifications covering molasses for foundry use. Molasses is a saccharine product separated from sugar in process of manufacture. It is a by-product in which the sugar has been partly removed by crystallization.

New Orleans molasses is the product of the manufacture of sugar in the old fashioned way, in open kettles and without the aid of vacuum pans and is considered the best grade of molasses. This may be considered the first grade. The second and third grades are more impoverished products. The chemical analyses of the three different grades of molasses shown in the accompanying table give the increasing content of dextrose, levulose, ash, acids and gum, and the decreasing content of pure sugar or sucrose which is characteristic of the second and third grades molasses.

Analysis of Different Grades of Molasses

Grade	Total Solids per cent	Sucrose per cent	Dextrose per cent	Levulose per cent	Ash per cent	Albuminoids per cent	Amids per cent	Acids and gums per cent
First	80.00	53.60	8.76	8.00	4.00	0.20	0.94	4.50
Second	80.00	41.70	12.20	12.50	5.35	0.25	1.50	6.50
Third	80.00	31.70	15.00	16.50	6.30	0.30	2.00	8.20

The determination of the amount of the different sugars present is made by the polariscope or saccharmeter.

The best method to pursue in determining contaminations and adulterations would be first to ascertain if fermentation has set in by appearance and taste. Determine the gravity, degrees Baume, then find the amount of cane sugar and invert sugar by the polariscope or Fehling solution. Finally, strain a certain amount of the molasses through a cloth to determine the amount of foreign matter present.

It would be a good idea to obtain working samples of the three grades of molasses and make your own standards. It will be a guide to you in detecting adulterations, and give you a working idea of what a good molasses should be.

N. P. Farrar has been appointed assistant sales manager for Pawling & Harnischfeger Co., Milwaukee. Mr. Farrar had charge of the Philadelphia territory for the past several years.

Patterns Are Made of Plaster

Material Is Used by Patternmaker Chiefly To Make Master Patterns and Coreboxes—Care Must Be Taken in Mixing Plaster—When Dried in a Kiln for the Proper Time the Plaster Becomes Hard

BY WALTER C. EWALT

PLASTER of paris, a variety of calcined calcium sulphate which forms a hard cement when treated with water, is used extensively in patternmaking. The reason for the name is the fact that it largely is manufactured in the neighborhood of Paris, France. The sulphate of lime is calcined at a temperature of about 300 degrees Fahr., and after parting with 20 per cent water, falls into a white powder. This powder will absorb water and again become a solid.

Historical writings show that the manufacture of plaster was an ancient art as it is said the pyramids of Egypt contained plaster work made 4000 years ago and which still is hard and durable. The Greeks used it in some of their famous temples as a ground for decorative paintings many centuries before Christ. The Roman architect Vitruvius, in his book on architecture written 16 B. C., gives detailed information on the methods of making and using plaster.

Plaster is used by the paternmaker chiefly to make master patterns and coreboxes. The master pattern and corebox, when molded, make the working pattern and box. To prepare the plaster for making the casts, it is mixed with water, always being added to the water. It readily may be seen that the degree of fluidity determines the ease with which the plaster will enter the small parts and corners of the mold. However, if the mixture is too thin, the dry plaster will be weak and porous.

To mix the plaster, the amount needed for the mold first is estimated and that amount of water placed in a pan or pail. Plaster of paris is shaken in the water, either with a flour sieve or dropped in gradually with the thumb and fingers. All the lumps must be broken and the powder thoroughly soaked. If thin plaster is desired, the paster is added until it comes to the level of the water, and if stronger plaster is wanted, additional material is added until the plaster is about ⅛ inch above the water. At this point some patternmakers are afraid that if the mixture is not poured immediately, the plaster will set. For this reason they stir it violently. However, if left undisturbed, it will remain fluid for a long time. After a few seconds

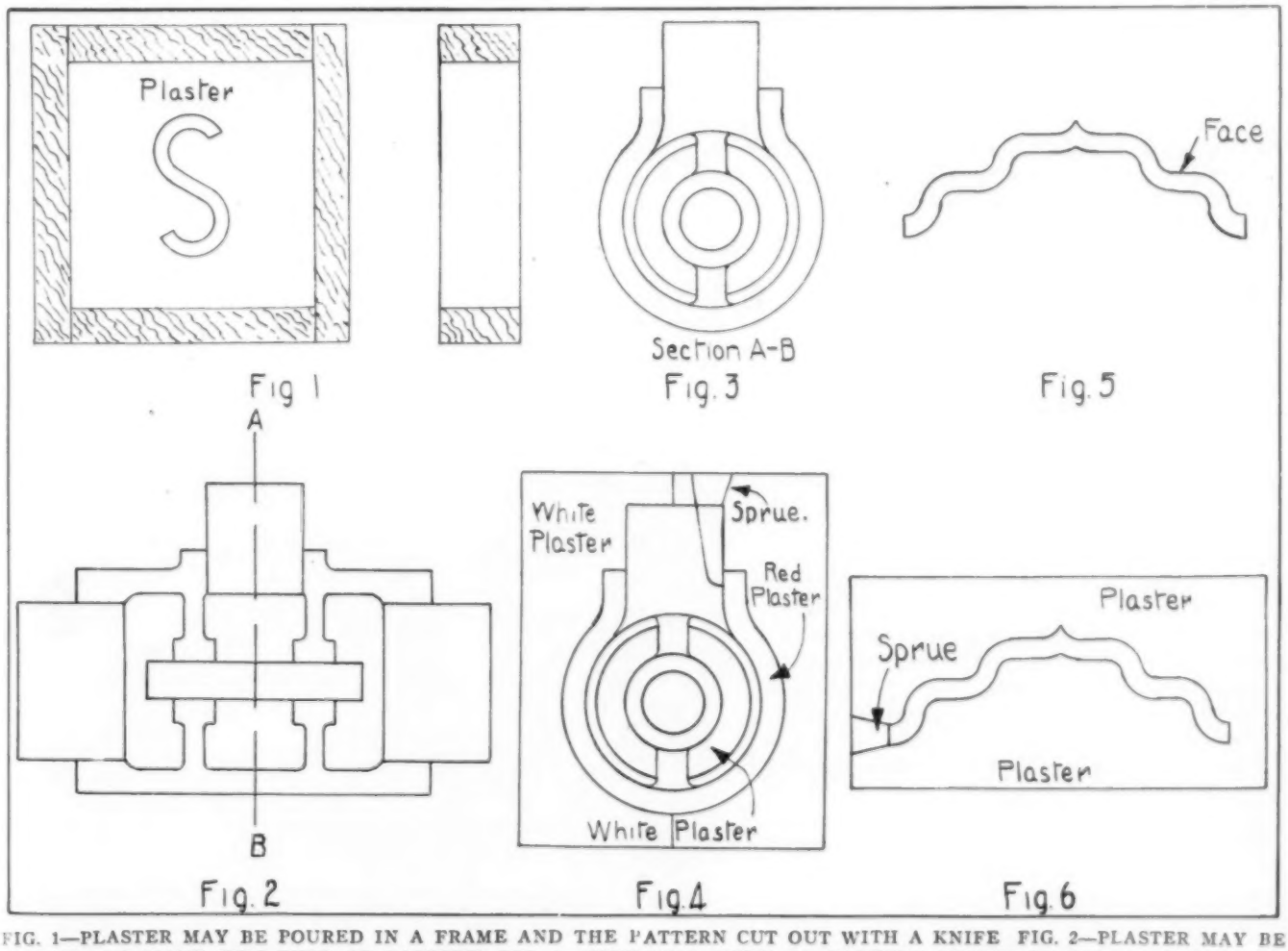


FIG. 1—PLASTER MAY BE POURED IN A FRAME AND THE PATTERN CUT OUT WITH A KNIFE FIG. 2—PLASTER MAY BE USED TO MAKE THIS TYPE OF PATTERN FIG. 3—SECTIONAL VIEW OF PATTERN SHOWN IN FIG. 2 FIG. 4—RED PLASTER IS USED TO DETERMINE THE THICKNESS OF THE METAL FIG. 5—THE FACE OF THE PATTERN IS CARVED IN WOOD FIG. 6—THE MOLD IS MADE AND THE PLASTER POURED

the plaster is stirred gently with a stick and when it starts to thicken, is poured in the mold. If prepared and used in the previously described manner, there will be no hard or soft spots. If the plaster is mixed to the consistency of cream or so that it has the feeling of having body to the fingers, it will set or become solid in 15 or 20 minutes. Some difference in composition of plaster may exist in different barrels, although the same firm may manufacture the product.

It may happen that a large number of small patterns are wanted, all different, and perhaps only one casting is wanted from each pattern. For example, the letters of the alphabet may be wanted, and instead of being raised, they may be wanted as space so that when a light is held back of the casting the letter will show. It would be an expensive job to make these of wood. However, they may be made of plaster as shown in Fig. 1 which represents the letter *S*. A wood or iron frame is made and laid over a board on which a white metal letter is fastened. The plaster then is poured into the frame and over the letter or the plaster may be poured into a frame and the letter cut out of the plaster with a knife. This method is far easier than cutting the letter out of wood. Numerous applications of this method of making patterns cheaply may be observed.

The frame or white metal letter is covered with a film of oil, linsed oil or common machine oil will do, to prevent the plaster from sticking to the board. Some patternmakers rub vaseline on the wood or metal. Too much oil must not be used since the plaster will push the oil ahead of it into the corners thus leaving round instead of sharp corners. Blowing the oil off with compressed air is good practice.

Where it is desired to find the thickness of the casting, plaster may be used to make the mold and core. Two views of a pattern are shown in Figs. 2 and 3, and the plaster mold is shown in Fig. 4. The plaster mold is made in halves which are molded over the outside of the pattern. The plaster core is set in the mold after the pattern is withdrawn, the mold closed, the two halves shellacked together and the mold turned on its side. Another batch of plaster is mixed and colored red or blue by using ink powder, and this mixture is run into the mold at the sprue. After the plaster has set, it may be cut into sections to measure the thickness of the red plaster, which represents the thickness of the metal plus the shrinkage.

Plaster is used in blocking out a pattern. For example, a thin block of wood, as shown in Figs. 5 and 6 is carved on the face and no attention is paid to the back. A plaster cast then is cast from the face and no further use is made of the block of wood. The plaster cast is lined with clay which previously has been prepared and made in narrow strips of the proper thickness. The clay and plaster are given a coat of oil and plaster is poured on top. The plaster in both halves is held in place by a wood frame when pouring. The two halves are separated, the clay removed and the two halves of the mold put together again. This leaves a hollow space in the mold, the shape and dimensions of the desired pattern. If a plaster pattern is desired, it is poured through the sprue as shown, the inside of the mold first being oiled. Hard wax also is used for patterns of this type.

After pouring, one half of the mold is taken off and the other half used as a match for the sand mold. The pattern which has been described generally is used as the master pattern, and when a mold is made with it in sand, the casting is used as the working pattern.

After the plaster pattern has been worked to size it may be put in a dry kiln and hardened. About 10 hours of heating is required and the plaster should have a ringing sound when snapped with the thumb and middle finger. If left in the kiln for too long a period the plaster deteriorates and becomes weak and brittle.

"A Chapter in American Education," is the subject of book by Ray Palmer Baker on the history of the Rensselaer Polytechnic institute, which recently celebrated its hundredth anniversary. The author discusses the origin and aims of the institution, the curricula and traditions, the natural sciences, the learned professions, the new humanities, the public services, canals and railroads, structures and mechanisms, business and industry and engineering education.

Pouring Cups Made on Plain Jolter

EVERY item of expense, no matter how small, must be held at a minimum to produce castings at the lowest cost. Many little items seem so small that they are overlooked. One of these is the production of pouring cups. While these cups are quickly made by hand ramming with almost any type pattern, in some steel foundries the quantity is so large that it pays to secure equipment for making the mold. The accompanying illustration shows the plain jolt machine used to produce pouring cup molds in a steel foundry in central Pennsylvania. The illustration shows a metal pattern for a single cup, but the smaller cups are made two at a time. A young man was broken in to the work and soon became expert in producing 400 of these pouring cups a day.

Milestones in Foundry Progress

As Recorded in the December Issues of THE FOUNDRY, Thirty, Twenty and Ten Years Ago

THE Association is to be congratulated on having such an ideal secretary as Mr. Howard Evans. As one of the gentlemen present said, "He is just the man; had he been made for the position he could not fill it more acceptably."

* * *

These commendatory words in THE FOUNDRY *of December,* 1984 *refer to the same gentleman who still fills in an able manner the office of secretary of the Philadelphia Foundrymen's association. The occasion was the third annual meeting, when Francis Shumann was president.*

* * *

A table compiled by James M. Swank of the American Iron and Steel association showed that No. 1 anthracite pig iron in Philadelphia from May, 1842 to June 1894 had fluctuated from a high of $73.62 a ton in August, 1864 to a low of $12.50 in May, 1894.

* * *

In 1894 Pennsylvania had 606 foundries while the number in the other leading states were as follows: New York, 560; Ohio 356; Michigan, 260, Massachusetts, 175; Indiana, 147, New Jersey, 139 and Connecticut, 113. Twenty cities had 20 foundries or more, while now there are 43 with that number of castings plants.

* * *

Chicago correspondent complained bitterly of the amount of credit paper offered in lieu of cash. He stated firms receiving notes and endorsing them often had the notes returned. Probably could have taken a lesson from the wealthy Isaac who when his poverty ridden friend Jake asked him to endorse a note, stating that President Jones of the Umptysteenth National requested it, became indignant. "For why," said Isaac, "should you mine vriend from a stranger borrow moneys? Me, I, mineself vill loan you, and you ged dot Jones to sign your note."

* * *

Henry Hansen stated that many believe that a foundry is a foundry like an egg is an egg; but as many of the latter are bad, so are the former. He was refering to the lack of training facilities offered and the then prevalent belief that workmen were not as competent as they had been in the past.

* * *

As Adam remarked to Eve when they packed a bale of fall leaves and left Eden for points west, "Things aren't like they used to be." Thus originated the expression, "Apple sauce."

Faked Foundry Facts

Trays

H. BOLLINCKX, operating a foundry in Brussels, Belgium, which was described in the December, 1904, issue of THE FOUNDRY, ascribed much of the improvement in his plant and practice to suggestions obtained from THE FOUNDRY and books of an American correspondence school.

* * *

Several employes of the Marseilles Mfg. Co., Ottawa, Ill., received a severe electrical shock when placing a ladle at the cupola spout. The molten metal served to convey the current from a power wire that had dropped across the stack.

* * *

In these modern days, there are few of those jays
Who think they are running a foundry,
But who in the end will find that it pays
If the chemist keeps them out of a quand'ry.
For the chemist can mix by analysis straight
Any pig iron, scrap or sundry;
And keep things going in spite of the fact
That such men are running the foundry.

BOOMERANG.

* * *

Thus did Boomerang repay the graceful compliments which Vinculum rendered in verse to the foundry chemist, as was noted in the Oct. 1, 1924 *issue.*

* * *

Pig iron was advancing, southern No. 2 having climbed from $13 to $13.50 in a months time.

* * *

R. F. Flintermann, then in Chicago had a comprehensive paper on losses in malleable foundries.

* * *

The Delphose Foundry Co., Delphose, O., completed its new plant.

* * *

Hilles & Jones completed a new foundry in Wilmington, Del. This is one of the components of the Consolidated Machine Tool Corp. of America.

* * *

The growing use of sand blast machinery in Germany was noted by Oscar Leyde, Berlin, who recommended this method of cleaning castings over the pickling or hand cleaning methods.

* * *

W. J. Keep reported that a ton of finished stove castings required 444 pounds of sand, taking the average over a period of one year.

MELTING iron shot in the cupola formed the theme of the leading article in the December, 1914 issue. It was written by G. E. Pickup, Wehrle Co., Newark, O. Stove plate was charged on the bed and then the shot was added in successive charges, 7220 pounds of shot being used with only 300 pounds of stove plate returns.

* * *

The foundry industry was operating at less than 50 per cent capacity. Business sentiment was weighted down by the pressure of the

(*Concluded on Page* 951)

THE FOUNDRY

Registered U. S. Patent Office

A semimonthly journal devoted to all branches of the foundry trade

Published by
THE PENTON PUBLISHING CO., CLEVELAND, O.

BRANCH OFFICES

BOSTON.....426 Old South Bldg.
CHICAGO.....1147 People's Gas Bldg.
CINCINNATI.....406 Edwards Bldg.
NEW YORK.....2203-2206 No. 220 Broadway
PITTSBURGH.....2148-49 Oliver Bldg.
SAN FRANCISCO.....675 Monadnock Bldg.
WASHINGTON, D. C.....84 Home Life Bldg.

FOREIGN OFFICES

BIRMINGHAM, ENGLAND.....Prince's Chambers
LONDON, ENGLAND, 2-3 Caxton House, Westminster, S.W.1
PARIS FRANCE.....23 Rue de la Bienfaisance VIIIe
Cable address, IROTRAPEN, London

SUBSCRIPTION

United States and Mexico.....$3.00 a year
Canada.....$4.00 a year
Great Britain and other Foreign Countries.....£1:0:0 a year
Single Copies.....25 cents
Copies published three months or more previous to date of current issue, 50 cents each

ADVERTISING

All communications relating to advertising copy, discontinuances, etc., must be received on the 1st and 15th of the month preceding date of publication.

Member, the Audit Bureau of Circulations, Associated Business Papers, Inc., and National Publishers Association
Entered at the Post Office at Cleveland as Second Class Matter

Copyright 1924 by The Penton Publishing Co.

Contents

What An Apprentice Thinks 917
Improve Shop Transportation 920
Note Faulty Pistons 923
Acquire Chicago Heights Manufacturing Plant 923
Describes Bell Founding—II 924
Publish Data on Alloys 926
A. S. T. M. To Meet in June 926
Melting Copper in the Cupola 927
Discuss Cupola Practice 928
Iron Buyers Meet 928
Forms Large Copper Crystals 929
How and Why in Brass Founding 930
Phosphor Copper as Flux 930
Estimates Yellow Cast 930
Zinc Alloys Iron 930
Pouring Brass Bushings in Iron Chills 931
Taking the Temperature of Molten Metal 931
Porous Aluminum Disks 931
To Obtain Bright Finish 931
Refining Metals Electrically 932
Grind Steel Track Castings 937
Bill Discovers How Bath Tubs Are Made 938
Lauds Pearlitic Cast Iron 941
New England Shops Test Pet Theory 943
Binders for Steel Stand 944
Testing Foundry Molasses 944
Patterns Are Made of Plaster 945
Pouring Cups Made on Plain Jolter 947
Milestones in Foundry Progress 947
Price Fixing and Price Cutting 948
Personal 949
Trade Outlook in the Foundry Industry 950
Develops Controller 951
Uses Small Head Room 951
Handles Light Loads 951
Designs Chipping Hammer for Foundry Use 952
Develops Machine for Sand Blasting 952
Builds Electric Elevator Stacking Tractor 952
Builds Indicating and Recording Pyrometers 953
Design Steam and Hot Water Heaters 953
Market Momentum Gains 954
What the Foundries Are Doing 955

Price Fixing and Price Cutting

WHEN a group of interests revert to price fixing or an individual chronically is addicted to price cutting, in any of the different phases of the terms, it is obvious that something is radically wrong. Price fixing usually is based upon suspicion and greed. Price cutting frequently is resorted to in an effort to gain advantage in the struggle for existence. The latter is more excusable, for it is inspired more often by the instinct of self-preservation.

A man has to play fair with his customers and competitors alike, if he wishes to realize the best returns in any commercial enterprise. To cause suspicion in the minds of his associates is detrimental. It is a sign of weakness and impending defeat. Price fixing usually is prevalent during prosperous times. It can be put into effect only by the sanction and cooperation of a body of men producing the same commodity. The price paid for such action is loss of prestige, loss of confidence on the part of the consumer, and public disapproval. The latter force when aroused by an injustice is powerful. When price fixing actions are exposed, it is a case of a small body of men versus the public. The latter always wins in the end.

Price cutting is brought about by business depression or selling prices and demand. When an era of pure cutting enters, failures ensue. The result sometimes is a survival of the *cleverest,* and not always of the fittest. When a price is quoted on any commodity that is questionably low, the wise prospective buyer becomes suspicious, refuses to have anything to do with the proposition and considers the bait too tempting for his own good. Price cutting may be regarded as a forerunner of dissatisfaction, a prophet of failure.

Competition stimulates a healthy condition of any market and it is a serious error on the part of foundrymen to try and overcome such a condition by price fixing or price cutting. The latter condition invariably results in lowering the cost of production at the expense of the quality of the castings, or in ultimate disaster to the one who sinks his price below his costs.

A business that has taken years of hard labor and conscientious effort to establish and build up can be wrecked in the shortest possible time by the present day evil of price slashing. A wise man will face conditions as he finds them during fat and lean business periods. He steadfastly will maintain the safe and sane policy of honesty, quality and fair returns.

At present the country is entering a period of increased manufacturing activity. Demand for practically all classes of commodities is growing. With this general trend, the urgent necessity for price cutting is removed and to resort to this plan to obtain business during this swing of the business cycle not only is unnecessary but dangerous. At such times prices tend to rise. Pig iron and coke already have responded to the first evidences of better business in foundry lines. Picture the results upon profits if castings prices are cut to the limit to obtain immediate business, figuring the costs upon the present market for raw materials.

Of course, the maintenance of satisfactory price is predicated upon a knowledge of costs. This fact has been urged by the technical and business organizations of foundrymen, has been stressed at conventions and has been supported by the periodical publishing of cost information in THE FOUNDRY.

Trade Outlook in the Foundry Industry

SLOWLY swinging upward, the general industrial situation is brighter, although the immediate reflex, as indicated in castings production is not pronounced. Foundries note increased inquiry, and many have detected a slight improvement in orders, but no sudden growth in business has developed, nor is it expected. Perhaps the best indication of the firm optimism among foundries is the increase in orders for iron for first quarter 1925 delivery. Many hastened to place orders within the first 10 days following the election, while now buying is steady but somewhat lighter than during the period mentioned.

Trend Is Upward

Building construction again is going forward, but with less impetus than during last winter. Residential construction is lagging behind the industrial and commercial classifications, but the volume is sufficient to guarantee a normal increase for home necessities and domestic machinery such as washers, sweepers, and other appurtenances. With the rise in farm commodity prices, prospects are favorable for a widening demand from rural sources. This, with the modern tendency toward the installation of all conveniences in farm dwellings, undoubtedly will influence the late winter and early spring demand for sanitary ware, electric pumping and other power machinery and similar items. Low interest rates which prevail offer encouragement for municipal and other public works extensions, while the development of electrical plants is bringing a wider range of demand from public service and individual sources. Slight increases in price on crude oil and the continued development of new fields is producing a steady demand from the oil country, which is bringing castings business to certain foundries.

Prices for Raw Materials for Foundry Use

CORRECTED TO NOV. 22

Iron		Scrap	
No. 2 foundry, Valley	$20.00 to 20.50	Heavy melting steel, Valley	$19.50 to 20.00
No. 2 southern, Birmingham	18.50 to 19.00	Heavy melting steel, Pitts.	20.00 to 20.50
No. 2 foundry, Chicago	21.00	Heavy melting steel, Chicago	17.25 to 17.75
No. 2 foundry, Philadelphia	23.13 to 23.76	Stove plate, Chicago	17.00 to 17.50
No. 2 foundry, Buffalo	22.50 to 23.00	No. 1 cast, Chicago	19.50 to 20.00
Basic, Valley	19.50 to 20.00	No 1 cast, Philadelphia	18.00 to 18.50
Basic, Buffalo	20.00	No. 1 cast, Birmingham	14.50 to 15.50
Malleable, Chicago	21.00	No. 1 cast, Buffalo	16.50 to 17.00
Malleable, Buffalo	22.50 to 23.00	Car wheels, iron, Pittsburgh	19.50 to 20.00
Coke		Car wheels, iron, Chicago	19.00 to 19.50
Connellsville foundry, coke	$4.00 to 4.60	Railroad malleable, Chicago	19.50 to 20.00
Wise County foundry, coke	4.50 to 5.00	Agricultural mal., Chicago	17.50 to 18.00
		Malleable, Buffalo	17.50 to 18.00

Rail Buying Continues

Although car loadings decreased immediately following the election, according to the reports of the American Railway association, the totals continue to indicate heavy shipments throughout the country. Further, purchases of cars serve to show a sound condition in railway operation. The total of freight cars ordered in the first half of November totaled over 10,000, which is more than twice the number placed during the previous month. The October total was 4885 cars. Inquiry for locomotives is improving. With the increased business on practically all railway lines, maintenance of way improvements and extensions should be accelerated during the coming year. Increased business is reported among textile manufacturers throughout the country; following a let down during the early part of October. This doubtless will be reflected in the demand for textile machinery castings. The manufacturers of stoves in the southern and western sections are buying much more iron than during the early part of the year. Eastern stove works note increased demand during the past few weeks. Prices of pig iron are strengthening, particularly in the South where the foundry melt is increasing steadily.

Auto Output Decreases

Production of automobiles of all classes decreased slightly in October, according to the department of commerce. The total aggregate 289,333 compared with 290,976, a drop of only 1643 cars or 0.57 per cent, which offers additional proof of the industry's ability to overcome the seasonal tendency in automobile purchases. An interesting fact is noted in the current report of automobile production. The manufacture of trucks has been advancing steadily since June, when the total was given as 27,894, to the October total of 31,433, giving a gain of 3537 or over 12 per cent. A satisfactory gain in the bookings of steel castings is noted by the department of commerce. The total orders for October reached 66,697 tons as compared with 62,509 tons in September. The October bookings represented 66.2 per cent of capacity, compared with 62.1 per cent for September and only 26.1 per cent for August. The orders for the past month showed the best in comparison with production for any similar period since last April. Railway buying is reflected in the increase of bookings of railway specialties in relation to capacity noted. October registered orders totaling 79.6 per cent of capacity, compared with 75.6 per cent for September and 37.2 per cent for August. The employment curve has taken a definite turn upward since the low point was struck in July according to the department of labor. At present unemployment is decreasing in the larger manufacturing centers. While the increase in farm commodity prices has not been remarkable, an interesting comparison is drawn by Leonard W. Ayres, statisticion, Cleveland. Mr. Ayres states that in October, 1923 a farmer was obliged to give 32 bushels of wheat and 45 of corn to pay for an automobile tire and gasoline enough to wear it out, while in October of this year the same purchase required only 15 bushels of wheat or 20 of corn. This gives a vivid picture of the difference in the farmers' buying power.

Brass Shops Active

Brass foundries making plumbing goods note increased demand during the past three weeks. Further, inquiries indicate satisfactory business following the first of the year. Prices on nonferrous metals, based on New York quotations in the *Daily Metal Trade* of Nov. 22, follow: Casting copper 13.37½c; electrolytic copper, 13.65c; Straits tin, 54.60c to 54.62½c; lead, 8.65c to 9.15c; antimony, 14.50c; aluminum, No. 12, remelt, 21.50c to 22.00c; nickel, 33.00c. Zinc is 6.80c, E. St. Louis, Ill.

Personal

Dr. Carl Benedicks, director of the Metallographic Institute, Stockholm, Sweden, will deliver a course of lectures during his visit to the United States which will culminate with an address before the institute of metals division of the American Institute of Mining and Metallurgical Engineers at the annual meeting the third week in February. Dr. Benedicks' itineray is not complete but his lectures will include considerations of abstract physical phenomena and specific studies of the theory of high speed steel, the determination of the specific gravity of molten iron and fundamental factors influencing corrosion.

John S. Csaklos who has charge of the construction of a new steel foundry for the Continental Axle Co., Edgerton, Wis., and who will be superintendent of the foundry on its completion about Jan. 1, has been continuously in the foundry business since 1911. His first position was with Isaac G. Johnson & Co., Spuyten Duyvil, New York. He removed to Milwaukee where he was placed in charge of the pattern storage and later was made foreman of the bench and squeezer department at the Sivyer Steel Casting Co. Later he was general foundry foreman for the Sterling Steel Co., East St. Louis, a position which he resigned to remove to Edgerton, Wis.

H. J. Criss, who recently established the Criss Sales & Engineering Co., Erie Pa., has accepted a position as general superintendent of the Wayne Agriculture Works, Goldsboro, N. C. and will take charge Dec. 1. The Criss Sales & Engineering Co., which conducts a general foundry engineering business, will continue under the same management and in charge of Carl Degner, Erie. Mr. Criss has been superintendent of the Southern Engine & Boiler Co., Jackson, Tenn., and the Coe Mfg. Co., Painesville, O., and has been employed by the Farrel-Cheek Steel Foundry Co., Sandusky, O. and the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

National Founders Meet

Legislative problems dominated the discussion at the opening session of the twenty-eighth annual convention of the National Founders' association held at New York, Nov. 19-20. Among the papers presented at the second session were "Foundry Cost Methods—Wise and Otherwise," by E. T. Runge, E. T. Runge Cost Co., Cleveland, and "Apprenticeship in the Foundry" by L. A. Hartley, supervisor of trade and industrial education, State of Nebraska, Lincoln, Neb. William H. Barr, president Lumen Bearing Co., Buffalo, was re-elected president and F .B. McBrier, Erie Steam Shovel Co., Erie, Pa. was made vice president.

Discuss Apprenticeship Training Courses

Reports of the Milwaukee convention of the American Foundrymen's association were made at the meeting of the Quad-City Foundrymen's association which was held in Rock Island, Ill., Oct. 27. Talks were made by Fred Kirby, Marseilles Works, East Moline, Ill., of "Apprenticeship", by Hyman Bornstein, Deere & Co., Moline, Ill., on "Sand Testing and Cast Iron Cupola Practice and Experiments" and by A. E. Hageboeck, Frank Foundries Corp., Moline, on "Importance and Necessity of Supporting the American Foundrymen's association."

L. A. Hartley, director of education of the National Founder's association discussed the necessity of useful education for a large percentage of our young men and women, who either by choice or necessity, leave school and go to work. E. A. McClintock commissioner of the National Founders association gave a short talk on industrial education, and how it keeps industries at the highest point of efficiency and repels foreign competition. Apprentice training will fill the ranks of the skilled workers which are thinned by the present immigration laws. He showed that a three year course in almost any industrial training will give a larger earning capacity to the worker. The Quad-City association has worked on the apprenticeship problem for two years and it is expected that a definite plan will be announced in the near future.

Appoints Eastern Agent

The National Foundry Supply Co., 143 Federal street, Boston, has been appointed New England agent for the Cleveland Flux Co., manufacturers of cupola flux, and brass and aluminum fluxes.

Frank D. Chase, Inc., 720 No. Michigan avenue, Chicago, has published a folder emphasizing the need of the foundry industry for better rather than more castings manufacturing plants. A number of foundries constructed by the firm are illustrated.

Obituary

William T. Nash, secretary and general manager, the Monarch Bumper Mfg. Co. and treasurer of the Atlas Foundry Co., Detroit, died at his home in that city Nov. 4. Mr. Nash was born in Windsor, Canada, April 4, 1873. In 1903 he became auditor and comptroller of the Cadillac Motor Car Co., remaining until 1917, when, with Henry M. and Wilfred G. Leland he became an organizer and was elected secretary-treasurer of the Lincoln Motor Co. He retained the latter position until 1922 when he resigned to assume those which he held at the time of his death.

Fred C. Lehman, a foreman for the Bass Foundry & Machine Co., Ft. Wayne, Ind., committed suicide at his home recently by inhaling gas. Despondency over ill heal this said to have been the cause.

Change Personnel

R. P. Brown has been appointed advertising manager of the Detroit Range Boiler & Steel Barrel Co., Detroit, succeeding Thomas M. Parker, who has been appointed Central States representative for the company, with headquarters at Detroit. Thomas Stinson, formerly representing the company in that territory, has been transferred to the Chicago district.

Made Sales Manager

Roland A. Wirfs, formerly president of the R. A. Wirfs Refractories Co., St. Louis, has been made western sales manager for the Keystone Refractories Co., New York, with temporary offices at 4609 McMillian avenue, St. Louis.

Opens Western Branch

The Sullivan Machinery Co., Chicago, has established a branch office and warehouse at 412 East Third street, Los Angeles with Benjamin P. Lane in charge.

Publishes Pamphlet

The Hillside Fluor Spar Mines, Chicago, has published a pamphlet giving suggestions for foundry practice. The discussion covers cleaning the cupola, a good mixture for clay daub, cupola bed, making the breast, lighting the cupola, charging the cupola, charging the flux, the slag hole, the blast, fluxing the cupola, the various fluxes, specifications for the purchase of coke and a table on how to figure the heat.

Refining Metal Eectrically

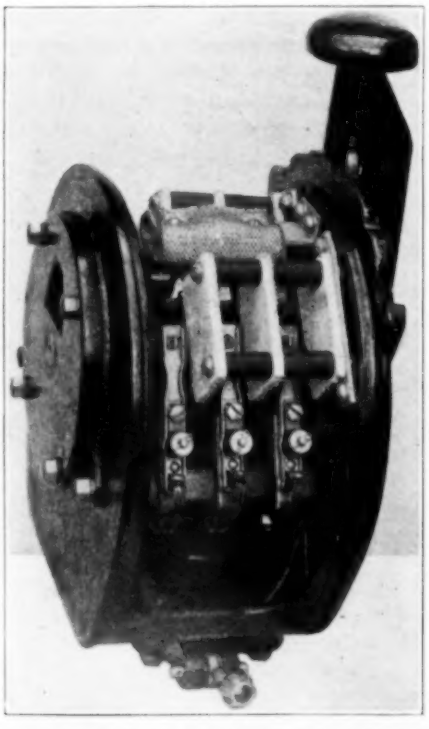
(*Concluded from Page* 936)

reverse. These comparative figures will change depending upon the size and character of scrap, rapidity of melting, slag volume, etc. Such a curve should be made for every furnace operating on this process to have at hand valuable information should occasion arise.

Fig. 28 shows such a curve plotted from several hundred heats covering the operation of a 3-ton furnace made by the Pittsburgh Electric Furnace Corp. This is based upon a charge consisting of approximately 25 per cent shop returns, the remainder being general boiler plate steel, the furnace melting 4 tons of metal in on hour, without any slag being added during this first period. While the figures shown vary slightly their average is close to analyzed tests and a correct enough to base additions upon when allowed a leeway of ten points.

Develops Controller

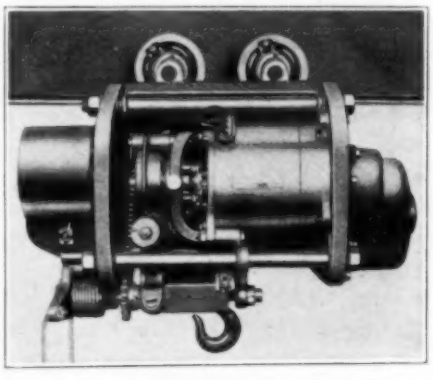
The Cutler-Hammer Mfg. Co., Milwaukee, has developed a new type of controller to meet the requirements of uniform periods of acceleration of motors driving auxiliary machines. The inductive principle is employed in the new controller, a transformer being used to control the time of acceleration. A holding out current of transient nature is obtained in successive accelerating switches through the transformer. Transfer of connections takes place automatically with the cutting out of successive steps of resistance without disconnecting the coil circuits. Adjustments for timing the acceleration to meet all requirements are made on stationary parts. In this new machine, it is said that the acceleration period is uniform under ordinary conditions of load variation, the time being increased somewhat with heavy loads.



MASTER FOR INDUCTIVE TIME LIMIT STARTER WITH COVER REMOVED

Uses Small Head Room

An electric monorail hoist designed to operate with small headroom has been developed by the American Engineering Co., Philadelphia, in ½ and 1-ton sizes. The hoist retains most of the features used in the hoists manufactured by that company, although it is smaller and lighter. The feature claimed for the new hoist is its ability to draw up a load until the hook almost touches the rail.



MACHINE STOPS AUTOMATICALLY WHEN LIMIT OF TRAVEL IS REACHED

Automatic holding and lowering brakes are provided and a safety device checks the hoist and throws off the current when the upper limit of travel is reached. High duty roller bearings and automatic lubrication are provided.

Milestones in Foundry Progress—1914

(*Concluded from Page* 947)

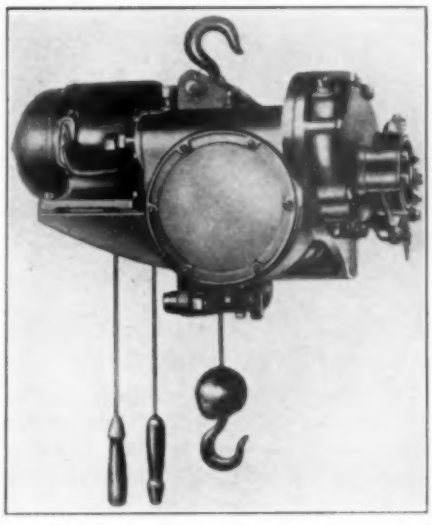
European cataclysm. No. 2 foundry iron was selling at $13, Chicago. Yet, David McLain, that apostle of optimism, reiterated his statement carried in an advertisement in the August, 1914 issue of THE FOUNDRY, that a quick return of prosperity would be noted. He had reckoned without the Kaiser, but repeated nevertheless that prosperity would come back, business would open up actively in September and close the month strong. He thought the war would be a long drawn out affair.

* * *

Pretty good prophet, Dave! Ever play poker?

* * *

The Jewell Steel & Malleable Co., Buffalo, completed a new coreroom.



THE HOIST IS WORM GEARED WITH WORM PLACED ABOVE THE GEAR

Handles Light Loads

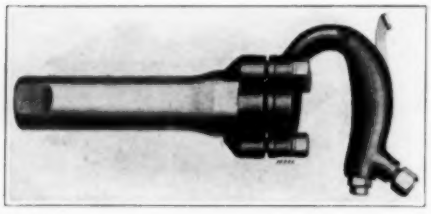
The Roeper Crane & Hoist Works, Inc., Reading, Pa., has developed a small electric hoist which is built with 500, 1000 and 2000 pound capacities. The hoist is worm geared with the worm placed above the gear. The worm shaft is equipped with a ball end thrust bearing. The main frame of the hoist is a one-piece casting and contains all ball bearings. An automatic stop of the trip lever type that is positive in its action affords protection in extreme lifting and lowering. The stop may be adjusted for any distances of hook travel. The motor is equipped with a mechanically-operated, jaw brake acting in series with the controller which brings the motor to a quick stop. Controllers are the single speed drum type of standard design. Push button control also may be furnished where necessary. For this control the motor is provided with an electric magnetic brake, and an adjustable upper and lower electric limit switch.

Grind Steel Track Castings

(*Concluded from Page* 937)

mately 1/16-inch deep. This machine also is used for grinding out lines, or the grooves where the car wheel flanges ride. This operation is called line grinding and is performed after the parts are restraightened after surface grinding. Wheels used for line grinding seldom are over one inch face. The wheel face is rounded to fit the shape of the line.

Another interesting operation consists of grinding out circular depressions in switch bases where the switch tongue fulcrums. This operation is performed under a drill press fitted with a special spindle and an artificial alumina cup wheel, 6 inches in diameter, 16 grit, P grade.



HAMMER BUILT FOR HIGH SPEED CHIPPING

DesignChippingHammer for Foundry Use

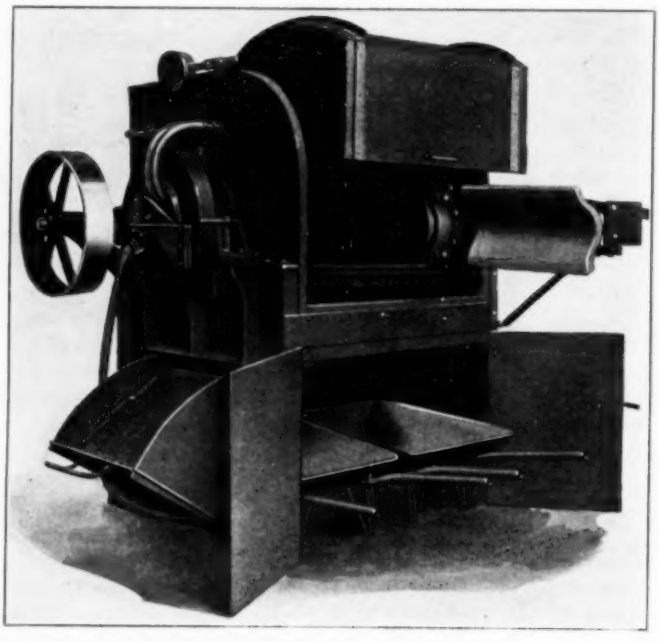
A new high speed chipping hammer for cleaning and chipping steel castings has been developed by the Ingersoll-Rand Co., New York. The main valve is a two diameter piece of the spool type and operates in a valve box sealed at both ends by caps. The entire assembly is clamped, concentric with the piston bore, between the handle and barrel.. The valve is timed by a groove about the piston and by the front end of the piston. The latter also is used to govern the exhaust in that end of the hammer. The handle is the open type, special attention being given to the shape of the grip and to the hand room. It is said that the throttle lever is placed so that the hand of the operator is not cramped in depressing it. The throttle valve mechanism is a combination of the piston and poppet valve types. The hammers are made in two sizes, the piston stroke being 2 and 2 7/16 inches respectively, the piston bore 1⅛ inches, the length overall 15 and 16 inches respectively, the weight 13¾ and 14½ pounds respectively, the size of hose connection ¼ inch and the size of hose recommended ½ inch.

Develops Machine for Sand Blasting

The Arcade Mfg. Co., Freeport, Ill., has placed on the market a sand blast machine which was developed by the Rockford Malleable Iron Works, Rockford, Ill., and used in its plant for several years. The shell of the barrel has a corrugated cylindrical surface to produce a uniform rolling motion. The parts of the machine subjected to the abrasive action of the blast, namely the barrel heads, the staves, door frame and door, are cast from a special mixture of manganese treated white iron. To eliminate wear on the bolts, the staves are bolted to the flange on the outside of the barrel heads. The barrel is carried on journals securely bolted to the heads. The driving power is delivered to the barrel through a gear and pinion, the former being bolted on one of the journals and the latter keyed into the pulley drive shaft. Each journal carries a floating plate through which the abrasive is projected by a nozzle.

The barrel door is secured by four clamps and is handled by a hand crane which is supplied with and mounted on the machine. Two air nozzles are inserted in the top which project the sand into the barrel through a specially designed sand nozzle. The sand nozzles are replaced by loosening two set screws and sliding out the worn nozzle, and may be replaced while the barrel is in motion. Sand hoppers are hinged at the bottom of the frame and are used to catch the abrasive as it falls from the barrel. A removable screen removes the foreign matter from the abrasive.

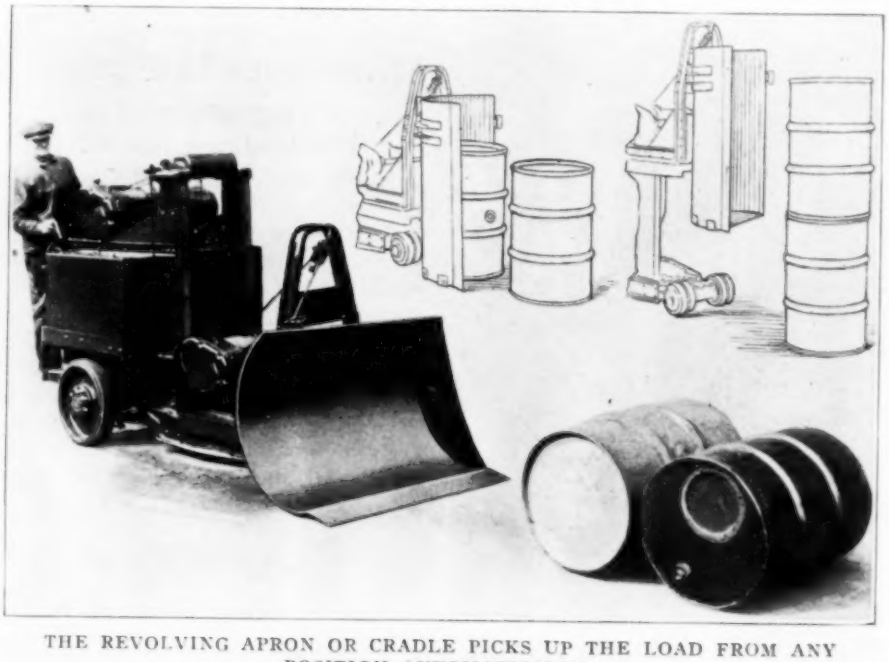
The abrasive material makes a complete cycle in the machine.



THE SHELL OF THE BARREL HAS A CORRUGATED CYLINDRICAL SURFACE

Builds Electric Elevator Stacking Tractor

An electric elevator tractor has been developed by the Elwell-Parker Electric Co., Cleveland, for transporting and stacking bulky cylindrical and rectangular loads, such as barrels, bales, boxes, etc. The unit will pick up the load from any position and will stack it either vertically or horizontal. The elevator raises the lower end of the load to a height of 6 feet. The unit consists of an elevator tractor with a revolving apron or cradle to secure the load at the end of the platform, the cradle being built to suit conditions. The load is raised or lowered by operating the elevating platform while the cradle is revolved to any position from the horizontal to the vertical by the additional hoisting unit. The two hoisting units are standardized with interchangeable parts. The power is supplied from one central storage battery. A view of the machine is shown in the accompanying illustration together with a sketch showing the method of



THE REVOLVING APRON OR CRADLE PICKS UP THE LOAD FROM ANY POSITION AUTOMATICALLY

stacking barrels one on top of another.

Two dual compensating wheels are used at the ends nearest the load. The standard safety devices used on the line of trucks made by this company are used on this truck, as well as additional ones covering the slacking of the elevator cable while lowering the load due to striking an obstruction.

Builds Indicating and Recording Pyrometers

A line of indicating and recording pyrometers has been designed by the Republic Flow Meter Co., Chicago. The clock of the instruments releases the operating energy, periodically through the power escapement no power passing through the timing escapement. Two independent charts are used instead of printing the two scales on one piece of paper. By using two separate pieces of paper it is possible to have any combination of scale ranges desired.

A tear groove directly at the driving drum allows extraction of the record easily without waste of chart. A clutch on each driving drum enables one to operate either or both charts as desired. The charts last 1200 hours. A carbon ribbon is advanced automatically across the face of the chart and the instrument pointer moves freely between a depressor bar and the back of this ribbon. The pointer deflects in proportion to the temperature at the hot junction of the thermocouple and it is claimed there is no frictional resistance at the pointer. Just before the depressor bars come down, the carbon ribbon moves forward covering the knife edge which runs the width of the charts and is located directly beneath the depressors.

When the carbon has advanced to cover the knife edge, the depressors drop and a dot is made on the face of the chart. The depressors then rise, the carbon drops back in place and the dot is made visible. All charts have degrees Fahr. to each division. Fifty ohms resistance is taken from a fixed resistor and placed in a variable rheostat having a scale 25-0-25 ohms, which is used to adjust any change made in extension leads.

FIG. 2—THE OFF AND ON DAMPING SWITCH PROTECTS THE PORTABLE INSTRUMENT

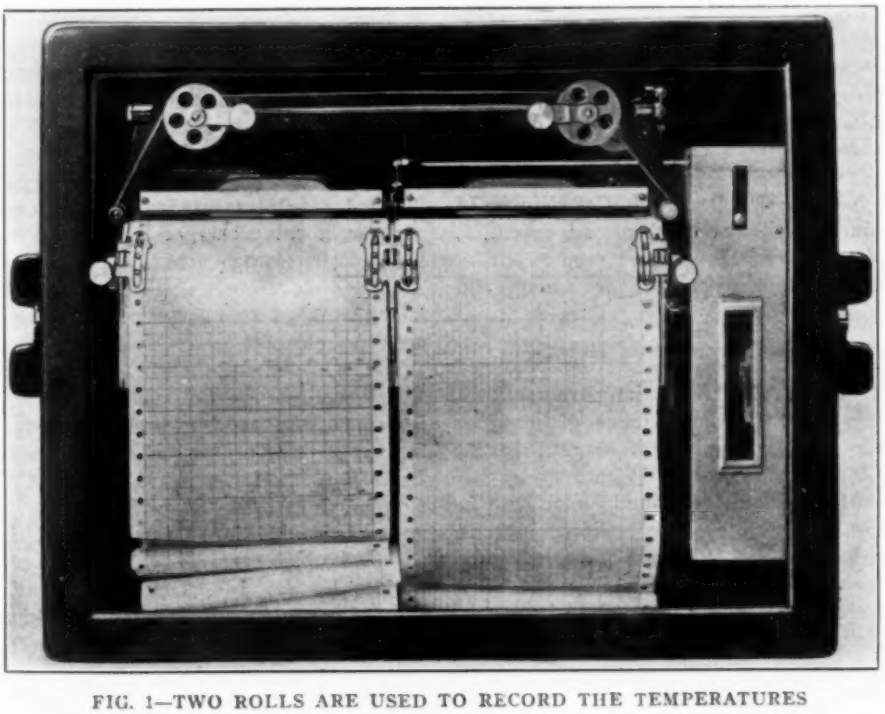
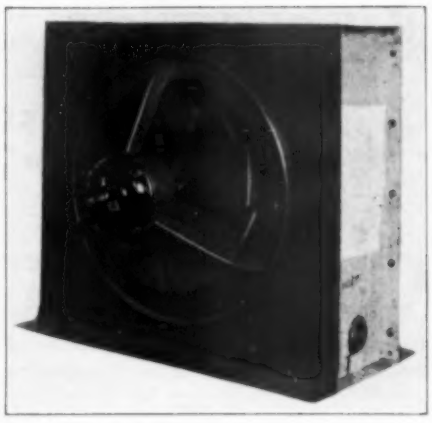


FIG. 1—TWO ROLLS ARE USED TO RECORD THE TEMPERATURES



THE FAN FORCES THE AIR THROUGH THE ROOM

A small toggle switch is built in the instrument which short circuits the magnetic field and damps the movement of the pointer when in transit. Fig. 1 shows the recording instrument and Fig. 2 shows the portable instrument used in checking.

Designs Steam and Hot Water Heaters

The Buffalo Forge Co., Buffalo, has designed a new heater for industrial plants where steam or hot water is available. Features included in the unit are light weight, a special fan design for distributing the air, rigidity and compactness. A series of heater tubes, the unit casting and a fan and motor constitute the component parts. The heater tubes are copper and are wound with a copper ribbon. The fan has 10 special cup shaped blades. Power is supplied by a totally enclosed motor equipped with thrust plug to prevent lost motion. Two different speed motors may be supplied, either moderate or slow, both being direct-connected. The method of attaching the motor to the fan may be noted in the accompanying illustration. The housing is of heavy galvanized steel, which protects the tubes. Space required by the heater is small.

Give Aluminum Data

The department of commerce announces that, according to data collected at the biennial census of manufactures, 1923, the establishments engaged primarily in the manufacture of aluminum castings, bars, plates, sheets, ware, etc., reported products valued at $106,930,367, an increase of 133.4 per cent as compared with 1921.

H. L. Mode has been made sales representative in the New York and Philadelphia districts for the Pawling & Harnischfeger Co., Milwaukee.

Market Momentum Gains

Manufacturers Report Substantial Improvement in Foundry Equipment—Sales Confined to Immediate Needs—See Heavy Buying Movement After Inventories

CONFIDENCE previously expressed by manufacturers of foundry equipment that business conditions in the market would improve after the national election seems to be justified in light of present developments. Builders are finding substantial betterment in the number of inquiries being brought out and many lists which have been dormant for some time again are being considered. However, sales at present chiefly are confined to immediate needs and manufacturers do not anticipate any great improvement toward active buying of equipment for increasing capacities or replacement purposes before the first of the year, since the inventories will be taken last of this month.

A number of building programs are being projected. The addition to the United States Cast Iron Pipe Co., Burlington, N. J., and the plant of the General Diecasting Co., Reading, Pa. are among the projects pending. The Blackmer Rotary Pump Co., Potoskey, Mich., is building a plant at Grand Rapids, Mich., including machine shop, foundry and power house at a cost of $100,000. The contract for the machine shop building and office has been let to Owen, Ames, Kimball Co., Grand Rapids. Work has been started on the foundry of the Mt. Vernon Car Mfg. Co., Mt. Vernon, Ill. The core room and ovens of the Ferro Machine & Foundry Co., Cleveland, which recently were damaged by fire are being repaired. The F. A. Coleman Co., Cleveland, has the contract for this work. David Garvie, Mary Street, Unley, Australia, is desirous of obtaining catalogs of molding machines.

New Projects Point Next Years Trend

MAKERS of foundry equipment generally in the Chicago district are experiencing a broader market. Many inquiries that have been pending for months seem nearer the closing point. One manufacturer states that in the past few days the market appears to have changed and that there has been quite a rush of new business. Among the sales made by the National Engineering Co., Chicago, are machines to the American Manganese Steel Co., Oakland, Cal., the Lake Shore Engine Works, Marquette, Mich., the United Shoe Machinery Co., Beverly, Mass., and the Studebaker Corp., South Bend, Ind. The Calhoun Casting Co., Battle Creek, Mich., has ordered sand-blast equipment from the Pangborn Corp., Hagerstown, Md. Other sales by that manufacturer include sand blast equipment to the Lake Union Brass Foundry Co., Seattle, the Wolf Mfg. Co., Chicago, and the Seattle Brass Co., Seattle, the latter company also securing a dust arrester installation. The Chicago Bearing Metal Co., Chicago, has purchased a sand-blast room from the W. W. Sly Co., Cleveland, while the Superior Foundries Inc., Milwaukee, has closed on a small sand blast tilted mill of the induction type from the same company. Among the other sales made by the Sly company are tumbling mill equipment to the Joseph F. Rothe Foundry Co., Green Bay, Wis., cinder mill equipment to the Rudy Furnace Co., Dowagiac, Mich., and the Peru Foundry Co., Peru, Ind., and dust arrester equipment to Dodge Bros., Detroit. The Mt. Vernon Car Mfg. Co., Mt. Vernon, Ill., has started the erection of a new $400,000 foundry, which has been contemplated for some time.

Market Lull Continues

DESPITE a general increase in foundry activity throughout the New England district, sales of equipment are still at a low point. Two of the large textile machinery manufacturers are inquiring for equipment, but actual orders are not expected before the first of the year. Most sellers of equipment report better inquiry, but a seeming reluctance to change inquiry into orders. The Walworth Mfg. Co., South Boston, Mass., has purchased tumbling mill equipment from the W. W. Sly Mfg. Co., Cleveland, while the H. B. Smith Co., Westfield, Mass., and the General Electric Co., West Lynn, Mass. have secured cinder mill equipment from the same company.

Improvement Is Noted

SUBSTANTIAL improvement is found in the number of inquiries for foundry equipment current in the Cleveland territory. With foundry operations increasing, foundrymen are taking greater interest in equipment needs, some of which have not been considered for some time as foundrymen were waiting for betterment in business conditions. Sales also have shown improvement although a marked increase is not expected before the first of the year since plants soon will be taking inventories. The tone of the market is much better and builders generally are optimistic. The Saginaw Malleable Iron Co., Saginaw, Mich., division of the General Motors Corp., Detroit, has purchased a sand-blast room with complete accessories, dust arrester equipment, fans and continuous tumbling mill equipment, from the W. W. Sly Mfg. Co., Cleveland. The same equipment manufacturer also has sold a sand-blast tilted mill of the induction type to the City Pattern Works, Detroit, tumbling mill equipment to the Humphryes Mfg. Co., Mansfield, O., continuous tumbling mill equipment to the Ford Motor Co., and cinder mill equipment to the Glamorgan Pipe & Foundry Co., Lynchburg, Va. Knapp & Sons Foundry Co., Akron, O., has secured sand-blast equipment and dust arrester installation from the Pangborn Corp., Hagerstown, Md. The Ferro Machine & Foundry Co., Cleveland, has purchased two large rolling drawer type electric core ovens from the F. A. Coleman Co., Cleveland. The Peerless Foundry Co., Cincinnati, and Smith & Wellstood Ltd., Bonnybridge, Scotland, have ordered charging hoists from the P. H. & F. M. Roots Co., Connersville, Ind. Several new plants and plant additions are reported in the formative stage. The Wayne Agriculture Works, Inc., Goldsboro, N. C. is constructing a modern woodworking plant 80 x 150 and a new addition to the foundry including cleaning and finishing departments. The company

is in the market for core ovens, grinding wheels and woodworking equipment.

Inquiries Show Gain

A SLIGHT gain is noted in the number of inquiries being brought out in the New York territory but little real improvement is found in sales. Sellers now are looking for a material gain in the rate of buying after the first of the year. Prospects in the way of inquiries extent are most encouraging for better business at that time. The feature of current business is the placing of some orders for future delivery in the expectation of higher prices later and also a fairly good demand for conveying equipment. The National Foundry Co. of New York., has ordered an additional 6000 feet of monorail, the order going to a Cleveland manufacturer. The Chapman Valve Mfg. Co., Indian Orchard, Mass., has closed on 1000 feet of monorail and transfer bridges. In the crane market the Ludlow Valve Mfg. Co., Tr N. Y., has purchased a 10-ton electric crane from the Morgan Engineering Works, Alliance, O., and the American Car & Foundry Co., New York, is inquiring for a 10-ton electric crane. Crane prices are tending upward. A Weiskittel & Son Co., Baltimore, has purchased a dust arrester installation from the Pangborn Corp., Hagerstown, Md., and Jay H. Nedbury & Sons, Goshen, N. Y., have closed on continuous tumbling mill equipment from the W. W. Sly Mfg. Co., Cleveland. One manufacturer expects to withdraw outstanding quotations shortly. Supplies are moving better, indicating somewhat improved conditions. Such coditions seem to be prevalent throughout the industry.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

F. Wabiszewski, Kilbourn- road, Milwaukee, is reported as inquiring for a 5 to 10-ton crane and an electric furnace.

Silverton Blow Pipe Co., Silverton, Oreg. has requested bids for constructing a plant, foundry and warehouse.

Lawler Iron Works, 18 Gull street, Buffalo, N. Y., has taken out a building permit for enlarging its foundry with a $6000 addition. The company operates a gray iron foundry.

United States Cast Iron Pipe & Foundry Co., Burlington, N. J., has awarded contracts to the Blaw-Knox Co., for erecting additions to its plant at Scottdale, Pa.

Miller Keyless Lock Co., Kent, O., operator of a brass foundry, contemplates constructing a plant addition. J. B. Miller is president. Maturity of the plans is indefinite.

Reading Foundry & Supply Co., Reading, Pa., is reported to have purchased a plant site, 180 x 240 feet, in Pottstown, Pa., for the construction of a foundry building.

Diversey Foundry Co., Chicago, has changed its location from 1651 Wolfram street, to the corner of Richards and Peyton streets, Geneva, Ill.

All Metal Valve Co., Louisville, Ky., has been incorporated for $25,000 to manufacture and deal in metal products, by Robert H. Hoge and Harry G. Davis.

Charlestown navy yard, superintendent of plants, Boston, has awarded to the New England Structural Co, contract for erecting foundry additions. F. J. Low Co. is general contractor.

The Anderson Pattern Works, Zanesville, O., is making inquiries in Racine, Wis., with a view to relocating its headquarters. It makes metal and wood patterns. John Anderson is president.

A. Denesha & Sons, Pitt street, Cornwall, Ont., will construct an addition to its foundry, and is interested in equipment, including lathe, drills, etc. They operate gray iron and brass foundries.

Alabama Stove Works, Inc., Birmingham, Ala., has been incorporated with $50,000 capital, to manufacture and deal in stoves, by D. O. Dortsch, Columbia, Tenn., president and A. T. Stanley, Bridgeport, Ala., secretary.

Troy Engine & Machine Co., Troy, Pa., operator of a gray iron foundry, has broken ground for a plant addition, made necessary since the acquisition of the engine business of the American Blower Co. The new unit will be of brick and concrete, 90 x 103 feet, and will house testing and other departments.

Hoyt Metal Co., 356 Eastern avenue, Toronto, Ont., contemplates erecting a new plant here to cost approximately $250,000. The Hoyt company operates brass and aluminum foundries.

Bids have been closed on the plant addition for the United States Cast Iron Pipe & Foundry Co., and American Bridge Co. awarded contracts for erecting structural steel in the new construction at Burlington, N. J.

F. A. Austin, 301 Wallace street, Syracuse, N. Y., has awarded contracts to J. D. Taylor Construction Co. for rebuilding a 1-story brick pattern shop recently damaged by fire. *Noted Nov.* 15.

Wayne Agricultural Works, Goldsboro, N. C., is in the market for grinding wheels, core ovens, foundry and woodworking equipment, according to D. W. Davis, president. *Noted Nov.* 15.

The Beach Foundry Co., Ltd., Hinton and Spencer streets, Ottawa, Ont., will construct an addition to its plant to be used for an assembly shop. The company operates a gray iron foundry.

Walker Mfg. Co., Hamilton and Michigan streets, Racine, Wis., has awarded contracts for a 1-story, 100 x 182-foot machine shop. The Walker company operates a malleable foundry.

Talladega Foundry & Machine Co., Tauladega. Ala., has been incorporated for $250,000 to own and operate foundries and machine shops, with Mrs. M. P. Clark as president and E. W. McDonald as secretary.

Allmetals Foundries, Inc., 116 South Clinton street, Chicago, has been incorporated for $25,000 to manufacture and deal in metals and their products. James J. Magner, L. B. Anderson and Kathryn Hartnett are incorporators.

W. C. Arthurs is president of the Mt. Vernon Car Mfg. Co., Mt. Vernon, Ill., which has retained Neiler Rich & Co., 431 South Dearborn street, Chicago, as architects for a 1-story, 240 x 350-foot foundry. Construction has been started. *Noted Nov.* 15.

Standard Foundry & Machine Co., Inc., Fifth and Washington streets, Boyertown, Pa., recently damaged by fire, plans immediate reconstruction. The plant, 2-story, 45 x 50-foot, was being used by day and night shifts on the production of radio horns. Many patterns were consumed by the flames in addition to the damage done to the building and equipment.

Hunter Heating Co., Frederick, Md., operator of a gray iron foundry, is making extensive improvements to its plant, including foundry room, cupolas, machine shops and pattern department, installing complete equipment. Markwood D. Harp is president.

Whiting Corp., Harvey, Ill., builder of cranes and foundry equipment, has opened an office at 997 Ellicott Square building, Buffalo, N. Y., to succeed its former agent, George F. Crivel & Co., that city. The new office will be in charge of W. R. Hans.

Otis Sawyer Boiler & Foundry Co., Oswego, N. Y., has been organized with $40,000 capitalization, to manufacture and repair boilers and operate a foundry, by J. F. Otis, W. F. and J. Sawyer, with J. L. Mournighan as attorney.

Gilson Mfg. Co., Port Washington, Wis., manufacturer of concrete mixers, and operator of a gray iron foundry, is starting construction of a new plant, 60 x 120 feet, with Albert Pergande, 445 Logan avenue, Milwaukee, as consulting engineer.

Standard Sanitary Mfg. Co,, Pittsburgh, has awarded contracts for constructing a new plant at Seventeenth street and St. Paul avenue, Milwaukee. Hunting & Davis, Pittsburgh, are architects, and Walter W. Oeflein, Milwaukee, is general contractor.

Midland Brass Works, Fifteenth and Jennings streets, Fort Worth, Tex., operator of brass and aluminum foundries, has plans for enlarging its capacity, following increasing its capitalization from $20,000 to $25,000 and changing its name to the Midland Mfg. Co.

State board of welfare, Baltimore, has $150,000 available for general improvement for the Maryland penitentiary and house of correction. Improvements include extension to foundry at the penitentiary for which Claude E. Sweezy is warden. *Noted Sept.* 1.

American Manganese Steel Co., Nineteenth and State streets, Chicago, plans constructing 2-ton electric furnace plant at Los Angeles for the production of manganese steel castings. D. H. Young, Los Angeles, is architect.

Plants of the American Range & Foundry Co., one in East St. Louis, Ill., and the other in Shakopee, Scott county, Minn., are

being offered for quick sale. The plants are equipped and operating, making stoves and ranges, using coal, wood, gas or combination. The business was established about 30 years ago, and since has been operating continuously. Bids on the property, in whole or in part, must be in the hands of C. D. MacLaren, trustee of the bankrupt estate of the American Range & Foundry Co., St. Paul, on or before. 10 a.m., Dec. 3, accompanied by a five per cent deposit of the bid price.

Hearing is scheduled to be held in the court rooms of the Federal building, Albany, N. Y., Dec. 6 at 10 a.m., and unless cause to the contrary be shown, the property of the Thacher Propeller & Foundry Corp. is to be conveyed to Edward K. Foley, Otto C. Peters and John Patterson, trustees. Hearings are before Frank Cooper, United States district judge. The properties involved are a 4-story brick structure and the walls of a burned foundry, 1-story brick forge shop, 1-story brick foundry, 1-story brick machine shop, 1-story cleaning room, 1-story frame core shop, 2-story brick cupola building, frame sheds and shipping buildings, and engines, boilers, machinery, equipment, patterns, implements, and tools. The company operated gray iron, brass and alumnium foundries, machine and pattern shops.

New Trade Publications

SLIP-PROOF FLOORS—The Norton Co., Worcester, Mass., sets forth the merits of its non-skid floor and stair tile, treads and aggregates in a handsomely illustrated booklet of 24 pages, showing installations in great variety.

CEMENT—The Keystone Refractories Co., Inc., New York, has issued a booklet describing some of the uses of a cement as a binder for fire brick, silica tile, and granular refractories. The booklet is illustrated.

MOLDING MACHINE—An electrically operated jar ram molding machine is described in a pamphlet issued by the Pneulec Machine Co., Ltd., Birmingham, England. The machine is entirely self contained.

FURNACES—Recuperator furnaces for the steel industry are described and illustrated in a folder published by the Combustion Engineering Corp., New York. A sectional view of the furnace is shown and the type of tile used is illustrated.

ELECTRIC HOISTS—Manifold uses of hoists are described in a catalog of Alfred Box & Co., Inc., Philadelphia. The full line of hoists manufactured by this company is described and tables of dimensions given, every detail of construction being illustrated by diagrams.

SAND-BLAST ROOMS—Rooms for sand-blast and grit blast are described and illustrated in a 12-page booklet recently issued by the W. W. Sly Mfg. Co., Cleveland. The various types of rooms to fit the different needs in the foundry are described. A partial list of users is included.

ELECTRIC FANS—The Buffalo Forge Co., Buffalo, N. Y., has issued a pamphlet of 16 pages describing fans for blowing, exhausting, ventilating, cooling and drying. The publication is well illustrated with views of the various types of equipment.

HAMMER DRILL—An electric hammer drill designed for drilling concrete and stone as well as chipping metals is described in a folder recently published by the Chicago Pneumatic Tool Co., New York. The device will operate on either direct or alternating current.

CONTROL EQUIPMENT—A 27-page bulletin on automatic station control equipment recently has been issued by the General Electric Co., Schenectady, N. Y. The bulletin describes briefly the uses and advantages of this type of equipment and is well illustrated. The greater part of the bulletin is devoted to a list of the installations up to Jan. 1, 1924.

FOUNDRY EQUIPMENT—Claiming a right to be regarded as a pioneer in the manufacture of foundry equipment the Whiting Corp., Harvey, Ill., is sending to the trade a circular covering broadly the line of equipment it offers. The covered wagon and coonskin cap embellishing the first page are reminiscent of the days of the long trail to the west.

HARDWARE—A catalog of 649 pages substantially bound in cloth has been issued by the F. W. Heitmann Co., Houston, Tex., covering its line of hardware, mill supplies and automotive equipment.

CASTERS—Ball bearing service casters with a frictionless pivot form the subject of a booklet by the Service Caster & Truck Co., Albion, Mich. which gives information as to types and uses.

TUMBLING MILLS—The Whiting Corp., Harvey, Ill., describes its line of tumbling mills in a catalog just issued, showing construction and operation, as well as engineering data on the equipment.

LIFT TRUCKS—Under the title "How to Pile," the Revolvator Co., Jersey City, N. J., describes its portable elevators, lift trucks and barrel racks in an illustrated bulletin. Applications of the various devices to specific uses are shown.

HYDRAULIC PRESSES—Application of hydraulic in lieu of other forms of power in processes not formerly using it is described in a booklet by the Metalwood Mfg. Co., Detroit. Hydropneumatic machinery are also shown.

CONVERTERS—As a saving and economical addition to the foundry the Whiting Corp., Harvey, Ill., presents its side blow converter through the medium of a catalog. Full instructions for its use and advantages of its use are given, with illustrations of actual installations.

INDUSTRIAL CARRIERS—A different method of handling material is provided in the carrier manufactured by the Ross Carrier Co., Benton Harbor, Mich., a full description of which is given in a booklet by that company. This carrier is designed for unusually long or high loads, which are placed on platforms or in boxes which are picked up and transported.

LADLE CRANES—Since handling ladles of molten steel is the most hazardous crane service in the industry, special care is required in design and material to insure absolute safety. In a current bulletin the Morgan Engineering Co., Alliance, O., shows installations of such cranes and the compensating device applied to double drum type ladle cranes.

SAND RIDDLES—A pneumatic sand riddle for mixing facing, core sand and other molding sands is featured in a supplement to its regular catalog by the Adams Co., Dubuque, Iowa. The machine is portable, sturdy and operated from the compressed air line in any foundry. In another supplement the Adams Co. describes its portable jolt squeezer which can be operated as a plain squeezer, combination jolt squeezer, or as a plain jolt machine, without adjustment.

ELECTRIC HOISTS—Floor operated hoists manufactured by the Shepard Crane & Hoist Co., Montour Falls, N. Y., are given full description in a catalog just published. Each type is described fully, an installation is presented in illustration and comprehensive data of the mechanism.

PNEUMATIC TOOLS—Portable air power used in a hundred and one ways, is shown in a well illustrated booklet of 72 pages by the Ingersoll-Rand Co., New York. Compressed air tools driven by portable or semi-portable compressors are shown on the job in scores of situations where they do more than hand labor can accomplish.

ROLLER BEARINGS—Use of these devices in belt-conveyors to reduce friction and improve operating conditions is described in an unusually informative catalog issued by the Hyatt Roller-Bearing Co., Newark, N. J. Charts, halftones, and statistical tables illustrate the text and details of construction are made clear by sectional drawings.

ROTARY DISPLACEMENT METER—An improved design of meter is described in a bulletin by the Connersville Blower Co., Connersville, Ind., the principal change being location of the bearings in a chamber at the ends of the impeller shafts, several intervening chambers protecting them from impurities in the gases. Operation of the meters and data of capacities and dimensions are given.

PNEUMATIC CONVEYORS—Transportation of a steady stream of dry material by air pressure from one part of a plant to another is illustrated in a bulletin by the Dust Recovering & Conveying Co., Cleveland. This installation carries a dry chemical product 400 feet through an overhead pipe at the rate of 2½ tons per hour by compressed air. It is presented as an illustration of what may be done in a general way.

ELEVATOR CONTROLLERS—Electric elevator control equipment manufactured by the Cutler-Hammer Mfg. Co., Milwaukee, has been given adequate representation in a 48-page catalog just sent out. Installations of large and small extent are shown and described, and detail of the various control devices is presented, including safety switches, door controls and brakes.

HEAT TREATING EQUIPMENT—Electric heat treating furnaces and similar equipment using oil or gas fuel are illustrated in two bulletins by Tate-Jones & Co., Pittsburgh, Pa. The latter are designed especially for pack and case hardening and annealing, and the former for application of heat under close control, with automatic regulation. The pages are well illustrated by halftones.

ENGINEERING DIRECTORY—The British Engineers' association has issued a directory of members and their manufactures, a special issue in connection with the British Empire exhibition. This is the sixth edition and covers practically every known line of manufacture. The association is recognized as a leading organization of British engineering industry having for an object the promotion and protection of British industry at home and abroad.

AUTOMATIC OIL VALVE—A shutoff valve for use on a fuel oil line is illustrated in a bulletin by the Johnston Mfg. Co., Minneapolis. A ball in the valve is carried upward by the rush of oil following a break in the line and effectually seals the valve. This action is similar to that of an electric fuse which breaks the circuit when an unusual rush of current takes place. The action of the valve prevents excess oil being lost in case of accident to the conveyor pipe.